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EMPIRE AND COLONIAL TUBERCULOSIS

A GENERAL SURVEY

BY

Professor S. LYLE CUMMINS, C.B., C.M.G., M.D.

Member of Council, NAPT

formerly Professor of Tuberculosis, University of Wales

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TUBERCULOSIS

CONTRAST BETWEEN PRIMITIVE PEOPLES AND
CIVILIZED COMMUNITIES.

“If the number of victims which a disease claims is the measure of its significance, then all diseases, particularly the most dreaded infectious diseases, such as bubonic plague, Asiatic cholera, etc., must rank far behind tuberculosis.”

ROBERT KOCH

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FOREWORD

That the Empire and Colonial interests of the *National Association* are becoming more widely known is due very largely to the Chairman of our Empire Committee, Professor Lyle Cummins. His name is known everywhere in the tuberculosis world, and he is perhaps our leading authority on the problem of tuberculosis as it exists in native and primitive races. We have therefore invited Professor Lyle Cummins to present his views in this short monograph. We feel it will be of the greatest interest, not only to doctors and health administrators, but to everyone who sincerely believes that the native races of the British Commonwealth ought to have facilities for the prevention and cure of tuberculosis.

At home in Great Britain our Tuberculosis Scheme has been evolving for the last forty years, and in the opinion of most authorities, is hardly yet complete. Progress cannot reasonably be expected to be more rapid in Colonial territories, and it is our earnest hope that the Colonies of the Empire may soon have well-developed anti-tuberculosis schemes.

In this great work we are confident that the basic knowledge of infection and resistance outlined in this book will be of service.

IVY PORTLAND,
Chairman of the Council.

R. A. YOUNG,
Vice-Chairman of the Council.

HARLEY WILLIAMS,
Secretary-General.

PART I

EARLY OBSERVATIONS

The first definite reference to the contrast between the original absence or rarity of tuberculous infection amongst those living in isolation and the later prevalence of the disease in a rapidly fatal form amongst those of them still susceptible, but now brought into frequent contact with infection, is that drawn by William Budd,⁽¹⁾ in his "Memorandum on the Nature and mode of Propagation of Phthisis," published in the *Lancet*, 1867, page 451. He writes thus:—"The following are the principle conclusions to which I have been led regarding phthisis or tubercle in the South Sea Islands. The contrast between the original entire immunity and the present extreme fatality is very striking and can only be rationally explained by the importation of a new and specific morbid germ. The late Dr. Rush of Philadelphia . . . satisfied himself that, when America was first discovered, phthisis was unknown among the native American Indians. Now it is very fatal among them. The very significant fact here established between the past and present history of the two races . . . is exhibited at once and at the present time among the Negro race in Africa It is well known that the Negroes are peculiarly liable to phthisis. Now everywhere along the African Seaboard where the blacks have come into contact and intimate relations with the whites, phthisis causes a large mortality among them. In the interior, where intercourse with the whites has been limited to casual contact with a few great travellers or other adventurous visitors, there is reason to believe that phthisis does not exist." We stand amazed at this penetrating and accurate statement, made before Koch⁽²⁾ had published his announcement of the discovery of the germ in 1882. It is true that Villemin⁽³⁾ was even then in possession of the knowledge that a germ was concerned and was destined to reveal to the world his experiments on the infection of rabbits and guinea pigs in the following year, 1868, but it is most improbable that Budd had heard of this at the time of publication or he would certainly have mentioned it in support of his contention that there existed a specific germ of tuberculosis. He must, indeed, have possessed that quick-silver type of mind which could seize upon the absence of infection and consequent absence of disease in isolated peoples and place

this in sharp contrast to the state of things after infection had been introduced—acute and usually fatal tuberculosis, inferring from this contrast the intervention of a specific germ to which Europeans had developed a semi-immunity but which was still a fatal risk to South Sea Islanders, American Indians and Africans.

How very different was the attitude of A. Hirsch,⁽⁴⁾ the Professor of Medicine in Berlin, who, in his second edition of 1881, in spite of the then recent discoveries of Robert Koch and the earlier findings of Villemin, the former only one year before the appearance of his great publication, the Handbook of Geographical and Historical Pathology, (translated into English as part of the New Sydenham Society Publications by Charles Creighton, M.D.), could still say, "All seems to show that the transmission of phthisis or tuberculosis from person to person only takes place under certain conditions; and I hold it to be at least doubtful whether these conditions are created simply by individuals living together in close intercourse." It is, however, easy to understand how unwelcome and even unreliable the new discoveries of Koch must have appeared to one who, long before their enunciation, had closely studied the incidence and prevalence of tuberculosis throughout the world with nothing but the theories of "disposition" and "discrasia" to guide him, and untroubled by the blinding light of the dawn of a new era in the history of tuberculosis. And yet, in his thorough and painstaking studies of tuberculosis and of its geographical and historical aspects, he had accumulated a vast treasury of facts bearing directly on the points at issue. Why, one is constrained to ask, did he not eagerly seize upon the germ theory of Koch, and with it complete his picture and give a splendid finish to his work? Was it, perhaps, a deliberate inhibition, the application of his imagination? Such a use of his imagination was probably what Hirsch most distrusted. With true German persistence and perseverance he saw his part in the accumulation of facts rather than in the interpretation of them. Let us pay him the compliment of quoting largely from his great work for the purpose of emphasizing the truth as we see it today.

"A very remarkable fact in the geographical distribution of consumption on European soil," he begins, "is its rarity in many of the islands and coast districts within the northern latitudes, such as Iceland, the Faroe Islands, the Hebrides, the Shetland Isles and places in Norway." . . . Schleisner (1849) says that the disease is very rare in Iceland. "It would appear that it is not with any national peculiarity that we have to do from the fact that Icelanders who migrate to Denmark fall into consumption not infrequently." We have recently read a similar story where the

non-tuberculized Laplanders sent two of their Chiefs, men in perfect health, to New York, where both subsequently died of tuberculosis ! “ In the Hebrides the disease is almost unknown ; in the Shetland Islands it is said not to have been at all common until recent years ” (Sexby, 1871). “ Tous les médecins,” says Martin (1844) “ sont d'accord pour affirmer que cette maladie devient d'autant moins commune qu'on avance vers le nord.” The same would appear to have been true of Sweden, where the disease was at that time more prevalent in the southern than in the northern parts. “ In Finland and the Baltic Provinces there is little of it except in the large towns.” In Russia, “ from the central and southern parts of the country we hear of it as frequent in Novgorod,” etc., . . . “ but among the Kirghiz of the Steppes it is quite unknown.” In this connection it is interesting to recall the work of Metchnikoff⁽⁵⁾ Burnet and Tarassevitch (1911) who traversed the Steppes in 1909 and 1910. They found, among the Kalmouk Tartars two distinct types ; those who inhabited the central districts, still more or less isolated, with a low percentage of “ positives ” among children and adults and, as a contrast, those of the peripheral areas, where contact with the Russian population was intimate, with percentages of “ positives ” which were inordinately high and cases infected or dying from the disease extremely numerous.

An interval of about sixty years had made a great difference but the central areas still showed the effects of isolation. Hirsch proceeds to give some interesting instances from *Nearer Asia*. “ As regards Armenia, Wagner (1845) says the disease is only seen in persons who have migrated from Arabia, Mesopotamia or the countries of the Negro.” Here we should postulate that the people of Armenia must have had considerable numbers of low-grade infections—perhaps not diagnosable as disease—since they were able to infect immigrants from less tuberculized countries. He goes on : “ Polach (1859) says the same of the Persian plateau where the indigenous inhabitants enjoy an almost absolute immunity.” He speaks further of the prevalence of the disease on the Arabian shore of the Red Sea, especially among those Bedouins who have “ exchanged the tent for the stone built house.”

He turns to India and cites many authors, whose works it is now difficult to obtain, in London at least, though it may well be that some of them are available in certain libraries. As, however, they give a rather vivid picture of the prevalence of tuberculosis along the coastal areas, and in the more low-lying parts of the country and its extreme rarity at high altitudes and in sparsely inhabited places, they are here given as quoted by Hirsch. “ It

was prevalent on the Malabar Coast (Hunter, 1850), at Cochin (Day, 1861), at Cannanore (Morgan, 1841) and in the Punjab (Hinder, 1854).

It does not occur so frequently in Lower Bengal and Assam (Ewart, 1880), nor in Upper Scind (Don, 1839), extremely seldom on the plateaux of the Western Ghats at levels of 4,000 to 7,000 feet (Murray, 1838). It is rare in the Nilgeri Hills (Young, 1823) and on the northern and southern slopes of the Himalayas (Schlagenheit, 1848 and Curran, 1871). "On one point all authorities are agreed, that the disease in that country (India) is of an extraordinarily pernicious type."

The disease is very severe in Ceylon (Marshall, 1822). In Cochin China the French medical officers are agreed as to its frequency (Oliver, 1864). In Japan, phthisis holds one of the first places among the causes of death."

In Mauritius, Doutrollau says: "La phthisie enfin est commune et marche avec une grande rapidité, plus encore chez les indigènes que chez les Européens."

In Africa, Hirsh reports that phthisis is often met with among the Hottentots of Cape Colony inhabiting the plains near the coast. It is much rarer in other classes of the population. "In the interior plateau of Southern Africa it hardly occurs at all." On the Senegambia Coast it is said to be very frequent but Carbonnel (1877) says that, in the tribes of the interior, the malady is of rare occurrence."

Pruner (1884) talks of the disease in Egypt "as becoming rarer in proportion as we proceed southward from the shore of the Mediterranean" "In Central and Upper Egypt it is decidedly uncommon but it increases in Khartoum and Sennar as well as in the whole basin of the Nile beyond the Tropic." "The plateau of Abyssinia is almost free from consumption (Blank, 1874). So he goes on for several pages describing differences that could only be due to the varying presence of what Budd describes as "a new and specific morbid agent" but which he regarded as explicable by some other cause. They led him, however, to get rid of one frequently cited explanation, "The mean level of temperature," he says "therefore, has no significance." He still thinks that adventitious circumstances may have an influence; perhaps he is right in this as regards the breaking down of infections but it would take a great deal of research to demonstrate or put it aside. "Consumption is much more prevalent on a wet and impervious soil," he says "than upon a dry and pervious one such as sand." He lays stress on the almost complete exemption of high mountainous regions such as the Alps, but is blind to the fact that the vectors of tubercle

bacilli, the numerous persons who are met with at lower levels, are absent from high altitudes. Hirsch accounts for the rarity of phthisis in the damp but elevated valleys and the dry elevations as due to the fact that "people who have been born and brought up at great elevations have been always under the necessity of making frequent, or perhaps deep, inspirations as a consequence of breathing a rarefied atmosphere; that they are continually practising a kind of pulmonary gymnastic, from which there proceeds a vigorous development of the breathing organs and a greater power of resistance on their part to noxious influences from without." He points out that crowding favours phthisis and speaks of it as being very prevalent in barracks, prisons and the like; an opinion which is based, as we know today, on the unshakeable foundation of the presence of a germ; and speaks also of "the special liability of the negro in civilized countries," a special liability which we now recognize as a sign of a faulty acquired resistance. In spite of the discoveries of Villemin and of Koch, to which, however, he refers with some appreciation in his Second Edition, he concludes:—"We must admit that the negative evidence against infection greatly preponderates over that of the very few positive instances"; a remark which stresses the natural reluctance to accept a new truth which was, perhaps, to be expected. Nevertheless, we are extremely grateful for a wide review of the subject of tuberculosis in its geographical distribution without which, and the many references to now unobtainable sources of information, we should have been left without a great deal of evidence which is of the greatest value.

Another very talented German, Deycke⁽⁶⁾, next calls for attention. After a consideration of tuberculosis amongst the Turks, a nation whose reactions to disease he had studied for years, he decided that they were much less immune than the German people and went on to generalize in the light of his experiences. "The more completely a people is tuberculized, the greater is the immunity and the smaller the death-rate; the less the tuberculosis amongst a people, the more rises the death-rate in proportion to the cases of the disease."

Von Becker⁽⁷⁾, too, noticed in 1904, the tendency of the Egyptians to suffer but slightly, "Among the Fellahin there is only the minimal disposition to tuberculosis," but, as he says, "we meet a very different picture when we look south of the 1st Cataract." There are the Berberines "in whom the lung tuberculosis is much commoner and whose main work as servants (to the Europeans of Cairo, Alexandria, etc., S.L.C.) increases their liability," and the negroes from Central Africa whose liability to tuberculosis is well known. "This is true of the Shilluks,

Dinkas, Beggaras, Gallas and even the Somalis." In his own words: "Teilen diese pragnante Tendenz zu tuberkulösen Erkrankungen . . . mit sämtlichen Gleidern der Affenarten, die auch hier—wie in Europa—fast durchweg an Tuberkulose zu Grunde gehen."

In January 1908, Cummins ⁽⁸⁾, who had been attached to the Egyptian Army since 1899, published in the *British Journal of Tuberculosis*, a paper which formed part of a report on tuberculosis in the services produced by that journal. Cummins, stationed in the Barh-el-Ghazal in 1901, had noticed the absence of tuberculosis amongst the Dinka tribesmen around Waw, the principal centre of the District, and had been impressed by the failure to find traces of the disease in the many children whose spleens he had percussed and palpated in the surrounding villages. This had struck him as being in sharp contrast with the marked presence of tuberculosis in these same Dinkas when serving with the Egyptian Army in the north, in Cairo, Khartum, etc., and this same liability to tuberculosis became more obvious when, in 1902, he returned from the Bahr-el-Ghazal and worked as Senior Medical Officer successively in both these stations. He began to collect notes on cases and accumulated a considerable number of instances. Early in 1907 he had the pleasure of meeting Lt. Colonel Melville, R.A.M.C., who had come to Cairo to inspect British Hospitals and who was invited to spend a day at the Egyptian Army Hospital at Abbassieh of which Major Cummins was acting as Commandant. The latter spoke of his conviction that there was much to be learnt about tuberculosis in general by studying the disease as it affected the Sudanese and, as a result, he was invited to contribute a short paper on the subject to the Service Number of the *British Journal of Tuberculosis* which was shortly to appear. He, therefore, started to reinforce his own experience by applying to his brother officers and found an almost complete confirmation of his opinion that the Sudanese tribes were virtually free from tuberculosis in their wild state. With these facts and such rough statistical matter as he had been able to collect—and with notes on the extreme liability of monkeys from the Sudan to infection when exposed to it in Cairo (it is to be noted that he had not yet found von Becker's paper and so could not refer to it)—he forwarded his report to the Editor of the *British Journal of Tuberculosis* in the autumn of 1907, and it appeared in January of the following year. This paper is remarkable as being the first publication in English, as far as the writer can trace, to attribute this liability to tuberculosis to absence of contact with the tubercle bacillus in members of the primitive tribes of the Sudan and their intimate contact with it

when taken into the Army and brought to the northern stations of Khartum, Cairo, Wady Halfa and Berber. "No proof exists," he says, "that these tribes ever get tuberculosis in their natural state. The tubercle bacillus appears to be absent from the Southern countries except in the vicinity of Government posts." "It is not military service but contact with civilization that would seem to determine liability to tuberculosis." He emphasizes that the disease is rare or absent not only among the Dinka but among all the more remote Sudanese tribes. "On the other hand, the disease is common in Egypt" "It is, therefore, probable that a wild Sudanese who leaves his own country for military service or other occupation to the north comes in contact *for the first time* with the tubercle bacillus." "The children of healthy parents in a community affected by tuberculosis belong to a stock that has hitherto successfully resisted the disease; while the offspring of persons whose race has been free from tubercle have had no such disease to resist." Major C. A. Johnston, I.M.S., who wrote the paper on "Tuberculosis in the Indian Army," appearing in the same number of the *British Journal of Tuberculosis*, while offering no theory to explain the sharp contrasts in susceptibility between one race and another, still is evidently puzzled by it. "If I were to parade a line representing each of the castes of India and ask any physician to select the best physique and the one least likely to contract pulmonary tuberculosis, I feel sure he would select the Gurkha, for he is a veritable pocket Hercules, and probably the Madrassi as most likely to fall a victim." And yet the Madrassi is fairly immune while the Gurkha is notorious for his liability to the disease! This, by the way, is a conclusive argument against the rejoinder so often made that all the liability to tuberculosis shown by the various races of the world can be explained by the miserable plight of the susceptible ones in respect to their general bad hygiene, bad housing and bad nourishment! The Editorial commentary, in the number of the Journal concerned, was as follows:—"There is room for interesting research here to ascertain whether the non-occurrence of the disease is due to unfavourable geographical conditions or to non-importation of the disease. For instance, it would be interesting to know if the Gurkha in Nepal suffers from tuberculosis to the same extent as he subsequently does on enlistment. . . ." This obviously important suggestion ought to have been carried out at once—that is, thirty-seven years ago—but it is probable that large numbers of the inhabitants of Nepal are now, like the inhabitants of the Native Territories along the coast in South Africa, very much infected with the bacillus though perhaps, in most cases, not

diseased. This tendency to be infected yet not diseased by the spread of tuberculosis by returning persons from infected environments appears to be as characteristic of races living under "scattered" conditions as of Europeans and will be discussed later.

Cummins⁽⁹⁾ returned to the subject again later, contributing to the "Transactions of the Society of Tropical Medicine and Hygiene," a paper entitled "Primitive Tribes and Tuberculosis." Here he applied the lesson learnt from the study of the Sudanese tribes in comparison to the Egyptians to primitive tribes everywhere as compared with the reactions of western Europeans to tuberculosis, quoting numerous authors in support of his contention (1) that man, living under primitive conditions, is practically free from tuberculosis, and that (2) man, when brought from a state of primitive existence and placed in contact with civilization, shows a very much greater liability to tuberculosis than civilized man himself. From this proposition, which he considered proven, he went on to ask "whether the second of these propositions is the result of the first; whether, in short, primitive man owes his liability to the disease to the fact that, having no previous contact with the *tubercle bacillus*, he is, as it were, virgin soil for that organism."

He quoted the works of Nageli⁽¹⁰⁾ and of Burghardt⁽¹¹⁾ to prove that civilized man was not to be considered virgin soil, the one having found 96 per cent. and the other 92 per cent. of persons between the ages of 20 and 90 years to have some degree of healed tubercle in the body. He turns also to the tuberculin test which shows that from 82 to 90 per cent. of persons react positively in European cities and that, while children hardly respond at all during the first two years of life, the number of reactors rises rapidly with increasing age, attaining to between 80 and 90 per cent. between 13 and 14 years. (Mantoux⁽¹²⁾, Calmette, Greysez and Letulle⁽¹³⁾, Von Pirquet⁽¹⁴⁾). On the other hand, he cites the findings of Wagon⁽¹⁵⁾ that only 12 out of 100 natives of Kindia, French Guinea, had reacted positively and 11 of these had "left their country and been much in contact with Europeans." He also quoted the work of Peiper⁽¹⁶⁾ who had very similar results in German East Africa and again mentioned Metchnikoff, Burnet and Tarrassevitch already cited. His article appears to be a complete vindication of his contention that absence of tuberculization goes with an absence of immunity to tuberculosis. The same applies to the work of H. Ziemann^(16a) who found only 4.5 per cent. sensitive to tuberculin in German West Africa. Time was to show, later, that the presence of tuberculization, as shown by the tuberculin reaction, does not necessarily mean immunity. As a matter of

fact, very high degrees of hypersensitivity appear to be associated with a marked tendency to break down with the disease if the subject is exposed to excessive work or physiological stress. The excess of tuberculosis following hypersensitive reactions as compared with what one might describe as the "normal" amount following slighter reactions was a marked feature of the tuberculin testing as carried out on native miners at Johannesburg in 1927-1929, as will be shown later. The human being entirely uninfected does not react at all to tuberculin. The human being slightly or strongly infected is in a different condition; his tissues are already on the alert; his reaction is nearly always high in relation to tuberculin; it is generally more marked in proportion as he is more liable to the manifestations of the disease; the partially immune person is usually the often-infected but always very resistant European who only reacts to relatively low dilutions.

PART II

INTERMEDIATE PERIOD

In 1911, appeared a wonderfully well-based paper by Bulloch and Greenwood⁽¹⁷⁾ in which they spoke of the concepts "which have been variously described as disposition, 'anlage,' diathesis, dyscrasia, constitution, habitus, temperament," etc.. They made some attempt to distinguish between these words but their main effort was to draw a distinction between "soil" and "seed" and while not entirely ignoring the "seed" to come down rather heavily in favour of the "soil." They appeared to find it difficult to be certain, among the numerous works cited by them from all those who had written of tuberculosis before the discovery of the bacillus, as to the fate of those who had grown up in entirely primitive surroundings. "Were it possible," they said, "to choose at random a large number of persons, to divide them at birth into two sets, to bring up one class in contact with exceptional opportunities for infection and the other in circumstances presenting what one may call usual, normal or wonted facilities, an examination of the differential incidence of phthisis would settle the question once and for all." Such a comparison, had it been possible, might not have been so sharp as they appeared to anticipate, though it is probable that there would have been a heavier incidence of tuberculosis amongst the group most severely exposed. But the comparison between two such groups, *both growing to maturity exposed to infection*, would be sure to provide anomalies, differences of "seed" if we wished to call them such, and would not really settle the matter at all.

What Bulloch and Greenwood ought to have called for, and it was soon to be available in many parts of the world, was a comparison between almost totally uninfected natives and the normal Europeans both exposed to "the usual, normal or wonted facilities" for infection. War was destined soon to bring the uninfected into the same environment as the already infected, and to demonstrate in its own tragic way the difference between the unprotected and the relatively protected. Not that this difference was to be appreciated by Bulloch and Greenwood or by the majority of those engaged in studying tuberculosis in England or in France or in Germany. These workers went on studying their own problems, rather puzzled by the rises and falls due to vast

movements of population and great differences in nutrition, but they were blind to the far more striking and, in essentials, the more instructive, differences offered them by the work of Borrel and others who had seen the light ! Nevertheless, there were not wanting those with a clearer conception of the truth. One of them was present at the meeting, and at the end of the discussion, spoke more heartening words. Dr. C. J. Martin, now with us as Sir Charles Martin, F.R.S., said : " The most striking advance which had been brought about in our time had been the discovery of the infective nature of tuberculosis and its exact nature. This knowledge had overshadowed the influence of soil. . . . We were working in the right direction in trying to minimize the possibilities of infection."

Nevertheless, it would be a great mistake to undervalue this wonderful paper of Bulloch and Greenwood which is full of the ripe wisdom only to be found in a life-long grapple with the elusive problems of Preventive Medicine. It was perhaps natural for them to be a little blind to the new while holding on vigorously to the old truths about tuberculosis. It is with regret that we pass on from their paper, of such great interest, to subjects that affect us more.

It was the discovery of the Von Pirquet tuberculin test that was to sever completely the old era from the new. The discovery of the tubercle bacillus was, of course, the essential thing, the final decision, but Koch had also discovered tuberculin, and with it, the Koch phenomenon. It remained for von Pirquet to elaborate this fundamental test for infection as opposed to disease. His paper, above quoted, must be described shortly in order the better to understand its bearing on our subject.

" If we vaccinate a man for the first time," he says—and let it be recalled that he is now speaking of small-pox vaccination—" we see at the point of inoculation no specific change during the first days but the vaccinal effect is produced only on the third or fourth day and reaches its maximum on the eighth to the tenth day. When, however, we repeat the vaccination after several months, we find that there appears, within 24 hours, a small local inflammation which afterwards disappears rapidly. From this early reaction we can diagnose a previous inoculation if we are not informed of the history. After careful study of these small eruptions in cow-pox inoculation I tried the same method in tuberculosis, and found that only individuals who had been infected previously with tuberculosis showed within 24 hours a local inflammation after inoculation with Koch's old tuberculin." This was von Pirquet's announcement of his discovery—or rather of his application of Koch's discovery. He then went on to

describe how he used his technique. "The forearm is scrubbed with ether ; then two drops of undiluted tuberculin are dropped about four inches from each other. Then, with a vaccinating lancet, a superficial circular scarification is made between the two drops for the control of the traumatic redness following the small scarification. Finally, the same scarification is made *inside* the two drops ; a few fibres of cotton are put on the drops so that they will not flow ; after five minutes the cotton is taken off. No dressing is applied. The papula is examined after 24 and 48 hours." Calmette's intra-conjunctival method, depending upon the same principal but applied to the eyes, need not be described as it is no longer used, but Mantoux's plan of placing the tuberculin in the intra-dermal tissue is a useful technique which is now generally used. There are the various Patch tests, too, which are now very popular. All these apply the same principle in their various ways. It is the principle that matters and it is for this reason that von Pirquet's method, developed from similar phenomena in cow-pox vaccination, is given above. The tuberculin test, applied as preferred, was to be the great simplifier on which would depend the comparison of those infected with those uninfected with tuberculosis when the latter were brought into touch with civilization and infection. For let it be thoroughly understood that to bring an uninfected native into touch with civilization is to bring him into touch with infection. Calmette⁽¹⁸⁾ has made this clear. Speaking of the power that tuberculous cattle have in infecting healthy ones, he goes on : " Il est a supposer que ce phénomène n'est pas special aux bovidés et que beaucoup d'hommes auxquels une infection benigne anterieure ou restée latente a conferé une immunité relative sont susceptibles, tout en restant eux-mêmes en apparence parfaitement indemnes, de semer dans leur entourage des germes virulents. S'il en est ainsi on comprend que la tuberculose puisse être propagée très aisement par les voyageurs européens qu' aucun signe objective ne permet de considérer comme de malades parmi les populations qui avaient été précédamment les mieux épargnées à cause de leur isolement dans les régions encore inexplorées du globe."

He goes on to consider the relative liabilities of peoples to the disease and adds the following significant words :—" Les races qui se montrent le plus sensible et chez lesquelle la tuberculose se manifeste dans ses formes le plus rapidement mortelles sont les dernières venues à la civilization." Let us now hasten to bring forward the work of Borrel, that great man who had not only the knowledge and the means—the tuberculin test—but the opportunity to bring about the investigation which has just been described as essential ; the comparison between those brought up

in contact with tuberculosis and those conveyed to a civilized environment in a quite unprepared state as regards tuberculosis. The first group is not, strictly speaking, a grouped collection of men at all. It consists of the men of the French Army, originating on French soil, not tested on this occasion with tuberculin but representative of the men and women tested by Calmette, Greysez and Letulle in previous years and to be accepted, as were those persons tested by them, as being about 60—80—90 per cent. positive. The second group is, of course, much more specific and consists of Senegalese recruits hastily brought into the ranks and hurried to France where she was being invaded by a desperate and powerful enemy. Calmette had inspired the testing of persons in Senegal as in most parts of Northern Africa. The number positive had varied from 4 per cent, 5 per cent, up to 7 per cent of positives in the villages of the interior; 20 per cent. to 30 per cent. in the towns. "We ourselves submitted a certain number," says Borrel⁽¹⁹⁾, "to the cuti-reaction on arrival direct from Senegal and noted 4 or 5 per cent. as positive." Be it remarked that the majority of these men bore the climate of France and of Germany very well. "L'inspection que nous avons put faire avant le rapatriement nous a permis de contraster la forme splendide de ces tirailleurs acclimatés." But there were two distinct diseases which took a terrible toll of the recent arrivals, the recruits, before the majority had established their immunity. These two diseases were pneumonia and tuberculosis. Pneumonia took its own way and, having struck hard at the Senegalese in the early months of their service in Europe, left the survivors almost entirely immune, partly, no doubt, owing to its own nature and partly because of an efficient vaccine which was soon available. With tuberculosis it was a different question. Borrel describes it thus: "Au début et au cours de la première année, les cas de tuberculose sont rares; ils vont ensuite en se multipliant du fait de la contagion dans la promiscuité des débarquements et la Senegalais reste toujours aussi sensible; il n'y a ni accoutumance ni innocuité." There were, in all, 1,215 deaths from tuberculosis amongst those who passed a time in the Camp at Frejus; 48 in 1916, 382 in 1917, 557 in 1918 and a total of 298 in the first five months of 1919. He speaks of "d'énormes paquets ganglionnaires" and considers the facial appearance and the finding of supra-clavicular glands to be of more importance than the ordinary diagnostic signs which are often absent when the disease starts and which are useless when it is really advanced. "The tracheo-bronchial glands are tuberculous in 80 per cent. of the cases" and autopsies show that almost always the tuberculosis has started there. "Les ganglions sont en voie de

caséification et sont manifestement le point de départ des généralisations soit par effraction du ganglion, soit par voie lymphatique, soit par voie sanguine.” “The glands evidently correspond to a first infection, to a tuberculous chancre, to erosive tuberculous lesions, which, according to the case, are situated on the tonsils, on the back part of the throat, on the larynx or at the level of the primary bronchi ” “There is often caseous pneumonia. At autopsy, one finds the caseous hilar glands included in the very centre of the pneumonic process.”

This is an excellent picture of the kind of tuberculosis which he was describing, the acute tuberculosis of the isolated African who has never met the disease before. He evidently feels this ; “The tuberculosis of the black Senegal recruit is of a special kind,” he writes. “The Senegalese is very susceptible.” “This is the result of his previous life in the Colony. He represents a *terrain vierge* from the point of view of tuberculosis. He has never, from his youth up till now, been in contact with the tubercle bacillus.” His illness represents “une tuberculose de l’adult de première infection se présentant avec toute la gravité de la tuberculose de l’infant ou du singe ou du cobaye, avec des formes d’une évolution suraiguë.” This is a terrible picture. The author can, however, confirm it as literally true. But, with it all, Borrel was not inclined to attribute it to race but, on the contrary, to the deprivation from habitual contact with the tubercle bacillus which might conceivably befall a member of any race when brought up in a certain way. “Il n’y a donc pas là une question de race et de susceptibilité de race. . . .” “At the camp of St. Raphael, the natives of Madagascar proved much less susceptible to tuberculosis than the Senegalese ; the Annamites, too, were much less affected. The Canaques, on the contrary, paid a heavy toll to tuberculosis ; 10 per cent. of the troops were found to be affected.”

Borrel’s article on the tuberculosis of the Senegalese recruit has not been read nearly enough in this reference. It is characterized by a sincerity and originality of thought, a beauty of expression, a wonderful accuracy of technique which gives it a solid place amongst papers on this subject. Cummins⁽²⁰⁾, in a later paper, called attention to the bearing of the question of tuberculosis of primitive tribes to the tuberculosis of civilized communities. After recapitulating the arguments already recorded in this paper he said : “If the arguments put forward in previous pages have met with favourable consideration it will be conceded that the main factor that differentiates one community from another in so far as concerns the prevalence of tuberculosis, is relative isolation from contact with infection. If this be so, it

must necessarily follow that, even in highly organized communities, such as those of Western Europe or America, there will exist marked differences in this respect." He went on to quote the articles, "National Health Insurance, Medical Research Committee, Special Report Series No. 18, 1918, and Series No. 46, 1920, by Dr. John Brownlee,⁽²¹⁾ in which three types of death-rate in terms of age are clearly proved to exist in Great Britain, a "young adult" type, a "middle age" type and an "old age" type, the latter obviously a special industrial phenomenon unconnected with the old age of general communities. This Report, not much noticed here because unconnected with foreign countries, provides evidence that two types of mortality exist in Great Britain, "the one in which a high death-rate exists in young adult life, prevalent in males along the west coast of Wales and the western islands and coast of Scotland as well as in Ireland, and in females generally," the other, a "middle age" type, prevalent in males in all cities and large towns of England and Scotland. Though explained otherwise and incorrectly by Brownlee, the young adult type of death-rate is obviously connected with a lower degree of contact with infection, than the middle age death-rate of the big cities and towns. Cummins also explained the susceptibility of infancy and childhood, as evidenced by the types of tuberculous disease prevalent in these age groups, by the limited time spent by them in contact with infection. He concluded that, just as the isolated native of a primitive community remains free from tuberculosis, but is extremely susceptible to it when exposed, so the infant and child are free from the disease but very liable to severe forms if exposed to heavy infection.

Another, and a very weighty communication appearing about this time, was the book by George Bushnell⁽²²⁾ dealing with the tuberculosis of the American Negro and of the American Indian. Bushnell gave figures for the American negroes before and after the American Civil War. The reports of the health officer, Charleston, South Carolina, showed that the tuberculosis mortality for both the blacks and the whites was high in 1822-30, lower for both up to 1841-48; then very much higher for the negro than for the white from 1865-1874 up to 1900. This, he explains, as due to the miserable conditions of hygiene of the negroes as compared with the whites. While the bad conditions of hygiene go far to explain the higher incidence among the blacks it appears to me improbable that they can explain the differences which still obtain between the two races in the way tuberculosis attacks them; the glandular, generalized and acute infections of the black as compared with the restricted sub-apical and, on the whole, the less

fatal types met with in the whites. It may be noted, too, that the negro continues to have a mortality about two or three times as high as the white. It looks as if the negro, though acquiring immunity at about the same rate as the white man but starting at a lower level, was still much behind him in regard to the power to resist tuberculosis when it invades. And it looks as if this had always been the case, to judge by the figures which Bushnell gives for Columbia for death rates per 1,000

<i>Death Rates in District of Columbia per 1,000</i>		
<i>Period</i>	<i>White.</i>	<i>Coloured.</i>
1880-1884	3.17	6.96
1885-1889	2.88	7.05
1890-1894	2.48	5.29
1895-1899	1.97	4.68
1900-1904	1.83	4.92
1905-1909	1.55	4.94
1910-1914	1.27	4.53
1915	1.14	4.07
1916	1.05	3.74
1917	0.93	3.12

The great increase of tuberculosis after the Civil War might be accounted for in the same way that we account for the marked tendency of the South African Bantu to die of tuberculosis, although proved to have a certain degree of infection before starting mining; *that the native, while tolerating infection when exposed only to its incidence amongst his own quiet surroundings, breaks down into severe tuberculosis when removed to very strenuous conditions of life.* It is clear that the South African native is no longer free from tuberculosis in his own village. How could he be when every year brings with it the return to the villages of a number of tuberculous or tuberculized miners to infect the local population. It was the same when the American negroes lived in the quiet conditions of agriculture imposed upon them by their owners; "the negro children played with the white children, the men were coachmen, jockeys, valets, barbers, body servants and cooks, and women cooks, children's nurses, waitresses, chamber maids and washerwomen." We quote from Bushnell's account of the intimate mixture between blacks and whites in the days of slavery but we would point out that, although fully justifying his claim that the negro was not exempt from tuberculous infection, there was none of the physiological stress which is incident to war and incident to the gaining of a livelihood by self-imposed toil, which has since been a characteristic of the male negro's life. It is as an incident in such self-imposed toil that the special liability

to tuberculosis becomes manifest and it is undoubtedly helped in its ravages by the very indifferent hygiene which also follows an independent life with miserable economic conditions.

Turning to the American Indian, Bushnell has a moving story to tell. Here the tuberculosis was terribly severe. After giving instances, such as the Indian Cavalry units, brought to demobilization chiefly by the prevalence of tuberculosis which was very greatly increased among them by life in barracks, he mentions other instances of outstanding liability. A number of Apaches, including women and children, were confined in Vernon Barracks, Alabama, and later, owing to the severe tuberculosis among them, a special village was built for them and "they were placed under most vigilant sanitary supervision." The results were very disappointing. The mortality from all causes is given below with the note that nearly half was due to tuberculosis !

Death Rates of Apache Prisoners per Thousand.

	<i>Years.</i>	<i>Death Rates.</i>
Old	1887-1888	54.64
Barracks	1888-1889	48.96
	1889-1890	109.69
	1890-1891	142.84
New	1891-1892	109.75
Villages	1892-1893	80.93
	1893-1894	98.36
	1894-1895	83.05

Here it is clearly seen how little the installation of well-supervised hygiene affected the marked death rates, half of which were due to pulmonary tuberculosis.

As Bushnell says, "The high mortality and the fatal course of the tuberculosis show clearly enough that the Indians had not that protection against tuberculosis which long contact with the disease has conferred upon the civilized whites *and the negroes*" (the italics are ours). It is quite true that the Indians were far less immunized than the whites and even than the negroes, but it is interesting, nevertheless, to find the latter quoted as evidencing a marked immunity ! The Report of the Commissioner for 1916 states that a large percentage of the Indian mortality from tuberculosis occurred amongst children. "If under two years of age it is almost inevitably the cause of death" "When the children die of tuberculosis and the older members of the family survive we think in general of faulty hygiene in a tuberculized population." And what about the instances when the older members of the family *do not* survive ? We consider that, here, we ought to think of faulty hygiene *and some other influence as well* !

It is evident that Bushnell thinks so too for he writes : " The Indian is often spoken of as pining like a caged eagle when brought into civilized surroundings as if his illness were of the mind rather than of the body. Those who have read the preceding pages need not be informed that the reason why he falls a prey to tuberculosis is because he has no previous vaccination against it." He quotes Gorgas⁽²³⁾ who says : " The American Indian in his attitude to tuberculosis resembles the African negro ; the American negro has already passed beyond the stage of primary or nearly primary tuberculous infection. . . . Climatic influences are negligible factors in comparison with the presence or absence of immunization against tuberculosis." The American Indian, the African Negro, the American Negro ! These three races, if we might call them so, represent three stages in the gradual acquisition of immunity against the disease. Colonel Bushnell and Surgeon-General Gorgas think the last to have now " passed beyond the stage of primary or nearly primary tuberculous infection " but, though more resistant now than the others, the resistance shows itself rather in a diminished incidence than in an alteration of clinical type. The native of Africa, in his eighth or ninth generation outside Africa, still shows a remarkable tendency to a kind of acute tuberculosis which differs but little from " primary " disease.

PART III

MORE RECENT INVESTIGATIONS

Before going on to the more modern work which strictly constitutes Part III, we must mention the contribution of MacVicar⁽²⁴⁾ to the subject of tuberculosis in South Africa; in many ways the most important of the papers about that country as being the earliest and the most intimate. MacVicar was a medical missionary and one of that band of devoted men who have done so much for the natives of isolated communities all over the world. We quote from his paper in the *British Journal of Tuberculosis*, 1909, but at the same time we bear in mind that his main contribution was to the South African Medical Record in 1908, and that the work was merely summarized for the B.J.T. In this summary he first of all describes the population of South Africa as then constituted or as constituted before his own time. The original occupants of the country were Bushmen and Hottentots, the former now almost extinct, the latter represented by the "coloured," the mixed products of Hottentot blood with such Europeans of Portuguese, Dutch, French and British origin as were available during the seventeenth and eighteenth centuries. These Bushmen and Hottentots were invaded and killed or turned out by the Zulu-Kaffir sections now occupying the coast lands from Mozambique round Port Elizabeth in Cape Colony, and the Bechuana-Basuto section which occupies a large part of the central plateau and the mountainous country of Basutoland; about four and a half millions in South Africa. The European invasions, first Portuguese, then Dutch and French, finally English, were chiefly in the Cape and now represent a mixed European population of about 1,125,000. The East Indian population of about 100,000 is chiefly in Natal. Speaking of the tuberculosis situation obtaining in South Africa at that time he explained that, as compared with a death rate in England and Wales of 1.62 per thousand (1902) the figures amongst the Europeans in South Africa were, for Cape Colony, 1.48, for Natal less than 1.0, for the Orange River Colony, 1.37 per 1,000. "Practically all deaths from phthisis were those of immigrants." The mortality among the Indians was about 2.5 per 1,000. "The Bantu population," he says, "is affected very unequally by tuberculosis." In Natal and the Native Territories the people

suffered much ; this be it noted very early in or before the vast exodus to the mine fields now so prevalent. The mortality was already perhaps twice or three times that of Great Britain. In the Transvaal and along the Upper Zambesi (Lewanika's country), on the other hand, tuberculosis was almost or quite unknown among the Bantu. The "coloured" population of the Western Province of Cape Colony suffered more than any other race, the average death-rate being quite four times that of Great Britain ; in Cape Town 7.1 per 1,000, in Worcester 8.3., in Stellenbosch 7.7., in Wellington 5.1, in Malmsbury 9.3 and in Beauford West (in the Karoo) 14.3. It should be noted that these extraordinary mortalities were in places where the tuberculous Europeans, at that time commonly sent to South Africa, where tuberculosis was supposed to be so rare and it was sure to be good for them, were in the habit of employing the "coloured" population as servants. It must be noted that bovine tuberculosis was very rare in South Africa except among the imported dairy cattle near Cape Town. One the whole, it was "rare among cattle owned by Europeans and practically unknown among native cattle." "The Bantu in the Native Territories are suffering severely from tuberculosis and yet their cattle—they are a cattle-owning people—are practically tuberculosis free." The Report of the Tuberculosis Commission,⁽²⁵⁾ Union of South Africa, must be next mentioned in this connection. This Report, while not unanimous, is still of the greatest value and should be read by everyone interested in the question of tuberculosis in Africa. Only a short extract from it is given here as it is not possible to do more than touch upon it where it happens to illustrate the points here made. It was called together "to enquire into and take evidence for the purpose of ascertaining the extent and causes of the prevalence and spread of tuberculosis in its various forms among Europeans, coloured persons, Natives and Asiatics in the different areas of the Union, and to enquire into and take evidence for the purpose of ascertaining the extent and causes of mortality of Natives employed on the Witwatersrand Mines, etc." It is probable that the calling together of this Commission was very largely the result of the publicity given to tuberculosis in South Africa by MacVicar in the articles above quoted. Here it will suffice to quote some of the paragraphs of the "Summary of the Facts concerning the Prevalence of Tuberculosis as regards Natives" from p. 123 of the Report :—

"Tuberculosis is of comparatively recent introduction among the Bantu tribes." "We are satisfied that it has now become a most serious menace to the future of the Native races throughout the Union ; that it is increasing and that, unless

effective measures are taken, it is likely materially to increase."

"The disease, however, prevails to a variable extent among the different Native tribes and communities, from a comparatively small degree in the raw Native who remains in his kraal and who has come into but little contact with civilization, up to a very large amount occurring among those brought under the influence of European industrialism and living under conditions, to the Native, of exceptional stress." "Pulmonary and acute general tuberculosis predominate, more especially among adult males. Among females and children there is a large proportion of glandular cases, mostly cervical, especially among the less civilized and raw Natives." "Owing to the extent to which the disease occurs on the mines and the large number of Natives employed thereon, together with their frequently changing personnel, the mining industry is one of the most important of all the factors in the cause and diffusion of the disease among the Native population." Further on the Report speaks of the curious fact that the persons confined to their villages are infected but do not develop the more acute forms of the disease:—"The influence of the open life of the kraal suggests an explanation of the circumstance, so frequently referred to in this report, that, in the kraals of those suffering from tuberculosis so few women and children appear to be affected with the pulmonary and the generalized forms of the disease, but that tuberculous glands seem to be the common manifestation. It is possible that the early limitation to the glands is because of the power of resistance not having been depressed by overstrain and unhealthy environment to which the men are exposed at labour centres." This latter passage is quoted with appreciation as it expresses the idea that seems to me to underlie the explanation already given, of the difference between the tuberculosis so prevalent in the native kraals once the disease is introduced, and the terribly acute and fatal forms observed on the mines amongst the males who have come up in the best of health but infected as proved by the tuberculin test. One more quotation is necessary before we leave this valuable report—a conclusion as to the type of disease prevalent on the mines:—"In its clinical and pathological characters the disease in the Natives differs markedly from that in the Europeans. At post-mortem the infection is found to be more diffuse and to partake more of an acute general systematic infection. The tendency to limitation of the lesion . . . by the supervention of fibrotic and caseous and calcarious changes is not seen to any extent." The subject is taken further by Allan⁽²⁶⁾ in his report of a tuberculosis survey of the Union of South Africa (1924) in which he states that "tuberculosis is a common and widespread disease among the

Natives of the Transkei and Ciskei ” and remarks that “ there is evidence that in their natural surroundings Natives in these territories have a considerable degree of resistance to tuberculosis.” “ It is difficult,” he says, “ without extensive examinations and diagnostic tests to ascertain the extent to which infection from returned mine boys is affecting the general Native population.” Figures suggested that about 25 per cent. had either contracted the infection on the Rand or from relatives who had returned from the Rand. Allan concluded that each race has its own index of tuberculosis. He thinks that this index is dependant on four factors :—“ Susceptibility of the different races and individuals to tuberculosis, chances of infection and degrees of infection, resistance of infected persons to disease, economic conditions.” With this brief reference to Allan’s paper which is a very good one and well illustrated by Charts and Tables it is natural to proceed to quote from the paper, No. XXX, of the “ Publication of the South African Institute for Medical Research ”⁽²⁷⁾ of 1932. This is described as “ the Report of the Tuberculosis Research Committee originally established by the Transvaal Chamber of Mines and later expanded into a Joint Committee by incorporation of Representatives of the Union Government.” It is the most thorough Report on tuberculosis in the Native races of South Africa to date. In addition to reports on the histories of the native races, of the conditions of recruitment for the mines, the methods of accommodation in the hutments and in the compounds, it contains a valuable paper on the natives of the Transkei and Ciskei by Dr. Peter Allan from which we quote some of the principle facts, as well as very important articles on the Mantoux test by Dr. Mavrogordato and by Mavrogordato and Pirie on the post-mortem findings in native miners compared with those of Londoners as taken from the autopsies made by Dr. Roodhouse Gloyne.

Allan must be quoted first :—“ Tuberculosis is very rarely met with among the European inhabitants,” he says, speaking of the Butterworth area ; “ among the natives, however, it is fairly common and the local medical practitioners state that about 10 per cent. of all natives who consult them are suffering from tuberculosis in some form or other. The two European doctors in Butterworth see some 5,000 native patients per annum. The proportion of tuberculous patients is about 9 per cent. so that in Butterworth area there must be at least some 450 natives affected by tuberculosis out of a population of some 23,000.” Dr. Fenel, the District Surgeon, produced his figures for one year. Out of 3,300 natives who consulted him, 298 were suffering from some tuberculous affection, i.e., 8.8 per cent. Type of tuberculosis :

lungs 272, glands 14, spine 12.” “ It will be seen that tuberculosis of the lungs is the most common form. Some of the cases seen were acute but many were fairly chronic, lasting at least three years and over, showing that the natives, under their own conditions, have a considerable power of resistance.” We may roughly consider the results of his tuberculin tests as between different tribes ; between the Pondos near the coast, for instance, and the Matatieles and the Basutos further away in the hills.

	<i>Male positives</i>	<i>Female positives</i>
<i>Pondos</i> (near the coast)	80 per cent.	88 per cent.
<i>Matatiele</i> (far from the coast)	31 per cent.	42 per cent.
<i>Basutos</i> (far from the coast)	51 per cent.	50 per cent.

Contrasts such as this show clearly how much more those nearer the coast and those more prone to take service in the Mines are tuberculized than those further inland and less affected by the Mines.

The result of Mantoux testing on arrival at the Rand must next be considered. It may be stated at once that none of the natives were tested with less than a dilution of 1/5,000. This means that the persons described as negative to the test must have included many who would have been positive to a stronger dilution if such had been used. It is necessary to allow for this in considering the results. Those showing a very marked “ positive ” characterized by vesiculation or some other severe reaction were described as PP ; those with an ordinary “ positive ” were called P. We merely give the numbers tested and the numbers per 100,000 of those positive with each dilution used, who developed tuberculosis in the ensuing year or so after the test, for the patients were carefully watched during their mining career to ascertain the numbers subsequently found tuberculous.

<i>Numbers tested by dilutions.</i>	<i>Positives</i>	<i>Cases PP and P developing subsequent tuberculosis.</i>
{ 1/5,000 or 10,000 57,659	72 per cent.	PP. 1,578 per 100,000 } P. 798 „ „ }
{ 1/100,000 20,810	55 per cent.	PP. 1,183 per 100,000 } P. 530 „ „ }
{ 1/1,000,000 9,007	51 per cent.	PP. 2,304 per 100,000 } P. 430 „ „ }
{ 1/10,000,000 6,503	48 per cent.	PP. 913 per 100,000 } P. 170 „ „ }

Mavrogordato comments that "The more positive the reaction the greater the liability to tuberculosis." This is indeed so. The greater numbers of PP reactors in every dilution subsequently getting tuberculosis as compared with the P reactors, is proof of it; and those reacting to tuberculin, whether PP or P, were found to be more liable than those with a "negative" reaction. It must be remembered that the "negative" group certainly contained many positives, only to be revealed, however, by testing with stronger dilutions of tuberculin, which was not done.

Finally, Mavrogordato may be quoted as to the failure of the native gradually to assume a definite resistance to the disease in terms of localization. "After giving due weight to the above considerations," he writes, "one remains impressed by the comparative lack of ability to localize his tuberculosis shown by the positively reacting adult native mine-boy." When we compare the tuberculosis of middle age with that of childhood and infancy in Europeans we are here struck with a very sharp contrast with the African.

Turning to the pathological consideration of these Africans as compared with Europeans we see, too, a marked difference. The Europeans, as typified by 200 cases post-mortemed by Roodhouse Gloyne, show 54 cases of fibrotic lungs, the Africans 3; the Europeans, 157 cavities, the Africans 63; and so on. But it is specially in the tuberculous affections of the abdominal organs that the difference is to be noted. It is thought wise to print here the differences as shown upon page 156, as follows:—

	Abdominal glands		Spleen	Liver	Kidneys	Intes- tine	Peri- toneum	Genito urinary etc.
	Mesent.	Other						
London	116	6	27	6	48	59	20	—
Africa ..	82	127	152	124	59	52	61	32

This vast excess of abdominal tuberculosis, especially of the spleen and liver, shows the tendency, in the African, to *generalization* of tuberculous infection. It is only in the mesenteric glands and in the intestines, two points at which entering infection is likely to make its mark, that the group of Londoners is excessive; instances, perhaps, of old ulcerations connected with phthisical sputum and of the chronic enlargement of the mesenteric glands so commonly retained for years without any local illness. We consider this comparative tabulation of autopsy findings one of the most important in the whole Report. Whether it be in the incidence of disease or in the kind of disease following induction of infection, the African native appears to have less immunity than the average European, the result, probably, of absence of

tubercle bacilli from the ancestors long years before infection became common.

There are a great many American contributions to this subject, dealing with the tuberculosis of the American negro and of the negro now residing in Jamaica ; both the descendants of African slaves brought from the West Coast in the seventeenth and eighteenth centuries, in other words about seven or eight generations ago. Of these the outstanding example is that of Eugene L. Opie⁽²⁸⁾ whose work, as exemplified by his studies of the "Epidemiology of Tuberculosis in Negroes," we quote in full acknowledgment that many others also have made equally important statements to the same effect. Were we to attempt to quote them all we should need a much larger space than can be given in the present report. "Of ten million coloured people in the country" (America), he says, "25 thousand die every year from tuberculosis." This is 2.5 per cent., a terrible price for any country to pay in tuberculosis deaths from one of the most prolific and hard-working of its races. He goes on : "For coloured people the mortality from the disease in both men and women reaches a maximum between the ages 20-24 when it is more than four times that of white people The total death rate, unlike that of white people, is somewhat less in coloured men than in coloured women." It would appear that the average death rate per 100,000 from 1925 to 1927 was, for the white race, 68.9 and for the coloured 203, a ratio approximately 1 to 3. The disease attacks the negro children with far greater severity than the white. "The death rate has fallen rapidly between 1911 and 1913 in both white and coloured ; the per cent. fall for each age-group being somewhat less for coloured than for white."

"During the last two years"—that is from 1928 onwards—"studies have been in progress under the auspices of the International Health Division of the Rockefeller Foundation to determine the prevention and mode of spread of tuberculosis in Jamaica." The island has a population of 800,000 coloured and 15,000 white people. Some of the questions asked about negro tuberculosis are as follows :—

Has the negro an hereditary racial susceptibility to tuberculosis ?

Do the social and environmental conditions under which the coloured people live in this country expose them to massive infection when they come in contact with the disease ?

Are many of the coloured people in the country peculiarly susceptible to tuberculosis because they have not been exposed to it during childhood ?

He quotes the experiments of A. E. Augustine⁽²⁹⁾ which show that

dust from thirty-one homes of negroes regarded as clean, contained, in six instances (19 per cent.), tubercle bacilli, whereas dust from nine homes regarded as dirty contained tubercle bacilli five times (55 per cent.). Dust from the homes of 26 white people *with open tuberculosis* contained tubercle bacilli five times (or 19 per cent., and from the homes of fourteen coloured people similarly affected six times (or 43 per cent.) “The observations made in Jamaica indicate that those (negroes) thus affected scatter tubercle bacilli in vastly greater numbers for much shorter periods of time than those (the whites) affected with the usual chronic type of pulmonary tuberculosis. . . .” “They tend to transmit the same acutely fatal disease among those with whom they are in intimate contact and apparently have little opportunity to disseminate minor infection widely.” In another paper, “Anatomical Characters of Tuberculosis in Jamaica,” he writes : “The lungs from a small number of Jamaican adults are described because the disease has the characters of tuberculosis that occurs during infancy and early childhood in people of European origin. They furnish evidence that many native Jamaicans escape tuberculous infection during childhood and in adult life suffer with tuberculosis that resembles that seen in young children. Furthermore, these lesions help to explain the acute course of the disease prevalent in Jamaica.”

It would seem that Opie, like Cummins before him, was mistaken in this belief that acute tuberculosis in the adult negro was the result of escape from tubercle bacilli in early life. This conclusion was based upon the finding of many persons of African race, already proved to be virgin soil to the tubercle bacillus, as the Senegalese of Borrel with only 4 per cent. of positive reactors, dying from this acute and child-like type of disease. It has since been shown that this idea is wrong and that the African, even when showing a high tuberculin sensitivity, still dies with acute fulminating tuberculosis when exposed not only to reinfection but to excessive and unaccustomed exertion and fatigue. He goes on : “In all the Jamaican autopsies reported above and in those just cited careful dissection failed to reveal any scars of preceeding tuberculosis and the lesions of the lungs and lymph nodes had all the characters of first infection.” This, too, was just like the majority of post-mortems seen in South Africa. It is now expedient to mention several observations carried out in Africa, or in Zanzibar, an island inhabited by persons of African origin, undertaken by medical men sent out by the Medical Research Council or detailed by local Governments, their reports coming under consideration by the Tuberculosis Committee of the Medical Research Council. All three reports, by Captain S. M.

Burrows, R.A.M.C., R. J. Matthews and C. Wilcocks, were published as a Supplement to "Tubercle" in January, 1935. Burrows⁽³⁰⁾, in his report on the Dinkas of the Southern Sudan, went over the same ground in 1934 as had been examined by Cummins in 1902, the subject of a report by the latter to the *British Journal of Tuberculosis* in January, 1908.

His results are exceedingly interesting, and allowing for the fact that 32 years of full occupation of the Bahr el Ghazal by the Anglo-Egyptian Government had intervened, they confirm Cummins' observations very well. "No reference to tuberculosis amongst the indigenous tribes of the Bahr el Ghazal can be found in the works of early explorers previous to this century," says Burrows. "Dr. George Schweinfurth, who travelled in the Province from 1868 to 1871, and Dr. Wilhelm Junker from 1875 to 1883, make no reference to the disease. Professor S. Lyle Cummins, who was in the Province in 1902, found no evidence of the disease amongst the natives, cattle or wild game. He states that, "if present, tuberculosis is exceedingly rare amongst man and beast in countries occupied by Sudanese tribes free from contact with foreigners from the north." Cummins had recorded what appeared to him to be the earliest cases in the Province; in 1905, three cases, in 1906, two cases, in Wau; one case in Rumbek in 1906, three cases among the civil population in 1907. These cases were all living near and associating with the native troops.

In an intensive search for the disease, Burrows found 173 cases divided up as follows:—Males, 109; females, 64; average age, 27.7 years; 149 pulmonary, 24 non-pulmonary. It is to be particularly noted that no cases were found in children under twelve years of age. He carried out 3,662 intradermal tuberculin tests, finding 36 per cent. positive amongst 2,369 males, 26.8 per cent. amongst 1,293 females; a total of 32.7 per cent. He includes in his report 1,487 intradermal tests carried out by Dr. Balsky, a Medical Officer of the Sudan Medical Service, amongst the Agar Dinkas around Rumbek. Amongst these the percentages of positives were 45 per cent. amongst males, 31 per cent. amongst females and 17 per cent. amongst children. These are very small numbers, but still of great significance. The early reactions amongst children, especially, show that they, too, although up to 1934 free from physical signs, are becoming infected and will soon be showing some of the diagnostic characters of the disease. The cases described in adults are mostly fairly chronic, nearly all of them alive after two or three years of the disease, and several evidently getting somewhat better; in other words, the kind of cases that are always observed amongst natives

who have not left the area or been disturbed by hard work. It is to be noted that a dilution of 1/1,500 of old tuberculin was used in most cases for the tuberculin tests, about 3 or more times as strong as the strongest dilution used in South Africa! Matthews,⁽³¹⁾ writing on "The State of Tuberculosis in the Protectorate of Zanzibar," traces the history of the island up to the present benign rule of H.H. Sir Sayyid Khalifa bin Harub and points out that the general complexion of the racial grouping has been subject to a good deal of alteration throughout the vicissitudes of the past. The present population is roughly as follows :—

Local Africans	..	..	..	..	66,555
Other Africans	..	..	..	..	46,593
Arabs	..	..	..	..	11,445
Asiatics (mostly Indians)	..	..	..	..	11,171

Burton mentioned, in 1860, the prevalence of tuberculosis and this disease was the probable cause of death of several royalties. "Today tuberculosis is common amongst Indians, Arabs and Africans in Zanzibar town." The results of the tuberculin test (Mantoux) in 1,200 persons free from tuberculosis was 67 per cent. of all males, 64 per cent. of all females, and 73 per cent. of apparently healthy males from schools, prisons and police lines. In the neighbouring island of Pemba 15 per cent. of males gave a positive to the test. In Zanzibar District, those reacting positively according to age were as follows :—

0-9	10-19	20-39	40-
14 per cent.	28 per cent.	50 per cent.	75 per cent.

As to the sensitivity of tuberculin, the result of tests in all races were as follows :—

1/100,000	1/10,000	1/1,000	Neg.	Total.
45 per cent.	79 per cent.	89 per cent.	11 per cent.	100

Higher dilutions were not tried but, though high, the numbers were less than in the mining population of South Africa which, it will be remembered, were positive to the extent of 51 per cent. to that dilution (1 in 100,000). Females showed a higher percentage of positives than males, especially those over 40, in whom it was as high as 77 per cent. in all and 89 per cent. in Africans. All the tuberculosis met with was "human" in type. No bovine bacillus was met with. Though the tendency seems to be towards a fall in the general death-rate from tuberculosis in and around Zanzibar, the factors militating against diminution are as follows :—

- (1) The prevalence of the disease among the Indians.
- (2) The incursions of fresh susceptible stock from the

mainland—stock with little previous experience of tuberculosis.

- (3) The social and economic conditions, personal habits and customs facilitating the spread of infection and the opportunities for intra-racial mass-infection.

The findings, as Matthews points out, point to the conclusion that (1) the susceptibility of a race or group of peoples to tuberculosis varies inversely with the experience of infection possessed by it. (2) The frequency of the disease varies directly with the opportunities for mass infection, which depends in turn, on the social and hygienic conditions. Other factors mentioned are the influence of "purdah," the ill-balanced diet of the natives, and personal hygiene. These, however, are given a subsidiary place. "The main centres of dissemination," Matthews says, "are the tuberculous households in the overcrowded parts of the town . . ." "The disease is spreading from these centres along the lines of communication to the remote villages . . ." "Today, according to the evidence of the tuberculin test, one-third of the town dwellers become infected by the tenth year of life and two-thirds by the twentieth."

Wilcocks⁽³²⁾ has contributed a most important paper, which deserves to be carefully noted as one of the best that have appeared on African tuberculosis. He worked at Moshi in Tanganyika Territory close to the heights of Kilimanjaro mountain and within 25 miles of Kibongoto, the place where Dr. Davies, to be later quoted, manages the patients from a large area of Tanganyika. "Moshi is a town of about 2,500 native inhabitants," and has the great advantage that it is a market town of considerable importance where many natives of the surrounding districts bring their merchandise for sale. The natives of Tanganyika Territory are mostly of Bantu origin though the Masai, a warlike tribe very little mentioned in this paper, are said to be, by origin, of Hamitic and Caucasian blood in addition to later admixtures. The Bantus are chiefly concentrated in the coastal plain and in the fertile highland areas. Cattle are kept in most districts, some at pasture in the daytime and driven into a protected area during the hours of darkness. "Others are housed in the huts with the natives at night and others are kept permanently in the huts, day and night." Bovine tuberculosis is, however, exceedingly rare in these humped zebu cattle. "Mothers often chew the food which they subsequently thrust into the mouths of the babies. Families dip their grimy and unwashed hands into a common pot of food and drink from the same uncleaned vessel. Parents sleep with their children in the

closest proximity though since each head is securely and totally wrapped in its own blanket, the risk from this proximity is probably more apparent than real. Spitting is universal."

But compare this with our own peasantry and take the climate into account and, we venture to think, the conditions are not so very or unusually deplorable! The native diet is very largely of farinaceous food and consists of maize, millet, manioc or wheat flour. Fish is an article of diet on the coast and the flesh of cattle and goats is used in some areas. "Except among the Masai milk is not much used, even for children. The principal drinks are water and native beer prepared from honey, millet and other cereals." "In calorie value the native diet is adequate, but there appears to be a deficiency in the fat-soluble vitamins." "In many parts, especially in hilly districts, the natives do a considerable amount of hard physical work." So much for the preparation of the "soil." Now for diagnosis of the disease. "The most convincing diagnostic procedure was thought to be the finding of acid-fast bacilli in the sputum of pulmonary cases, and it was on this finding that the majority of the cases were diagnosed." This is not to say that the other measures were neglected. Every case seems to have had the most thorough physical examination and it is only the modesty of the author that gives such examination a secondary place. The author had also a portable X-ray carrier with the electrical supply obtained from the back wheel of a motor car; the outfit required 2 or 3 seconds' exposure at a focus-film distance of 20 inches. As the author says, "Gross pulmonary tuberculosis was easily seen," but the finer diagnostic signs must have been obscured to a great extent. As to the criteria of diagnosis the following factors were insisted on:—(1) The discovery of acid and alcohol-fast bacilli corresponding to the classical descriptions of tubercle bacilli in the material discharged or withdrawn from the body. In the vast majority of cases such material was sputum. (2) Unequivocal X-ray findings. (3) Angular deformity of the spine. (4) Chronic sinuses having the characters typical of tuberculosis, leading down to chronically-enlarged joints, bones or lymphatic glands. (5) Classical signs of tuberculous joints.

The examination of sputum films was very thorough. "Throughout the investigation no slide was counted as positive unless at least four acid-fast bacilli were seen" "Acid-fast bacilli were found in a number of glands which were not apparently caseous by inserting the needle of a 5 cc. syringe into the gland substance and aspirating some of it into the needle and thence transferring it to a slide."

It was noticed that an unexpectedly high proportion of those in

whom the sputum was positive had basal findings when examined by the stethoscope. This was followed up with the following result :—

<i>Age Group</i>	<i>Upper and Middle Zones only</i>	<i>Lower and Middle or Lower Zones only.</i>
0-5	4	14 or 77 per cent.
6-15	39	36 or 48 „ „
16-25	57	52 or 47 „ „
26-50	95	108 or 53 „ „
Over 50	10	17 or 63 „ „

It will be recalled in this connection that Opie⁽³³⁾ in describing the lungs of children affected with and dying from tuberculosis of the primary sort, found that the bases were nearly as often affected as the upper and middle zones. It is curious and interesting that these Africans, adults for the most part, had the same type of distribution.

As Wilcocks says, “ The basal distribution may indicate a more severe type of lesion than is common at home.”

He then turns to the tuberculin tests carried out by him by the Mantoux technique. “ It will be seen that among the general population, none of whom showed any evidence of tuberculous disease, roughly 50 per cent. were positive to the test” “ These natives are not virgin soil to the same extent as those in certain French African colonies where the rate of infection, as judged by the tuberculin tests, is well under 20 per cent.” Moreover, the rate of hypersensitivity was evidently high. “ For instance, d’Arcy Hart (1932)⁽³⁴⁾ showed that in normal Londoners a reduction in strength of tuberculin from 1/1,000 to 1/10,000 resulted in a reduction in positive reactors of 25 per cent., from 88 to 63. In the Tanganyika natives, a reduction in strength from 1/500 to 1/50,000 resulted in a reduction of positive reactors of only 3 per cent.” This is fairly conclusive evidence. The only pity is that Wilcocks did not go on to prove it by testing in 1/100,000 and 1/1 million or over. But it is quite clear, as he says, that there was marked hypersensitivity to tuberculin, nevertheless.

We now come to the most interesting question raised by Wilcocks, that of the significance of acid-fast bacilli in the sputum. “ Acid-fast bacilli were found in the sputum of patients whose history and signs suggested lobar pneumonia, not necessarily apical, asthma and chronic bronchitis, and in that of many patients in whom no physical signs could be discovered at the time of first examination.” “ In some of these the signs were present subsequently but, in most, they did not become evident during the

period of observation, which was often short owing to the fact that the patients discontinued attendance at the clinic. . . .” “As the investigation proceeded, it was found that a certain proportion of cases in whose sputum acid-fast bacilli were found gave no reaction to intradermal tuberculin and this finding, together with those noted in the preceding paragraph, led to the suspicion that all the acid-fast bacilli seen in the sputum might not be tubercle bacilli. Animal inoculation and culture experiments which are described later were therefore undertaken but have, so far, failed to bring to light any *cultivable* acid-fast bacillus other than the tubercle bacillus.” In Moshi, 57 attempts were made to isolate bacilli from the sputum: “only nine were successful.” These attempts were by the antiformin method of Griffith and by Petroff’s method modified.

At Cambridge, later, Wilcocks tried the culture of 39 sputa, attempting the isolation of tubercle bacilli in 107 experiments. These sputa had been sent from Tanganyika by air-mail and had made the journey in ten to twelve days. Only in thirteen were these attempts successful; these from only six different specimens. “As before,” says Wilcocks, “contamination accounted for the majority of these failures but again, as before, many sterile tubes were found in which no acid-fast bacilli grew.” He comments as follows:—“Tubercle bacilli and other acid-fast organisms can usually be isolated with ease and regularity from specimens of that age but it is possible that, in some instances, the vitality of these air-transmitted sputa was lowered to a point at which they could not withstand the treatment necessary to kill the contaminants.” We fully endorse the proposition that tubercle bacilli are likely to be isolated “with ease and regularity” from such sputa and we must admit, too, the long arm of coincidence as a possible cause for the failures in other cases, but we think that its operation could only account for a very small percentage of the failures recorded. “It is, of course, possible that some of these acid-fast bacilli are not tubercle bacilli in that they produce no lesion in guinea pigs and that, therefore, they cannot be isolated through these animals. Of the tubes used in Cambridge in attempts at direct culture of Tanganyika specimens, 4 per cent. were positive, 20 per cent. were sterile and 75 per cent. were contaminated.” This very large number of contaminations may, of course, have hidden many tubercle bacilli. Some of these contaminants seem to have been almost as resistant to 5 per cent. sulphuric acid as the tubercle bacillus itself.

Animal experiments were undertaken to try to find out what was the reason of finding occasional acid-fast bacilli in the sputa of patients who presented no physical signs or only those of

asthma, who made good progress, whose tuberculin test was negative, and, in the case of those who were X-rayed, who showed no radiological evidence of tuberculosis. It should be noted, however, that all these cases complained of cough lasting for more than three weeks." Those sputa examined at Moshi were treated, as described, with caustic soda and then neutralised while those seen at Cambridge were treated with 5 per cent sulphuric acid. Fifty-five animals were used in all and the results are here given.

<i>Period of Survival</i>	<i>Negative Guinea Pigs</i>	<i>Tuberculous Guinea Pigs</i>
Under 10 days ..	11 (37 per cent.)	Nil
11-15 days ..	6 (16.15 per cent.)	2 (13.3 per cent.)
16-20 days ..	5 (12.5 per cent.)	2 (13.3 per cent.)
21-30 days ..	8 (20 per cent.)	2 (13.3 per cent.)
Over 30 days ..	10 (25 per cent.)	9 (60 per cent.)
Total ..	40	15

The numbers are very small and hardly justify their being expressed in percentages, but they point to something which is important; the fact that those guinea pigs which survive for thirty days or more are much the most likely to show tuberculous infection.

Wilcocks was aware of this, and took it into account in the paragraph which follows wherein, however, he brings vigorously to attention the essential fact which he is seeking to emphasize, the large number of acid-fasts which were without any lethal action on the guinea pigs concerned. "Disregarding those animals which showed no sign of tuberculosis and which died in twenty days or less, it is seen from this table that 15 sputa containing acid-fast bacilli produced tuberculosis in the animals and that 18, also containing acid-fast bacilli, which were indistinguishable from tubercle bacilli, failed to do so under the same conditions. If a thirty day limit is imposed instead of twenty, the proportion is 15 to 10."

He gives a summary of the patients whose sputa were inoculated into these guinea pigs as follows :—

	<i>Sputa which produced T.B. in animals.</i>	<i>Sputa which failed to do so.</i>
Number	15	18
From patients with- out physical signs	3	9
With history of hae- moptysis	6	6

	<i>Sputa which produced T.B. in animals.</i>	<i>Sputa which failed to do so.</i>
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With positive tuberculin test ..	5	4
With negative tuberculin test ..	3	2

Of the three cases which gave positive results in animals but no physical signs, two were negative to tuberculin, one of whom gave a history of haemoptysis. Of the three whose tuberculin tests were negative, one was negative to 1/10 tuberculin five months before the sputum was found to contain acid-fast bacilli. Another was negative to 1/10 tuberculin three months after the sputum test but was then recovering from whooping cough. The third was negative to 1/10 three months before the sputum was found positive. The negative tuberculin tests cannot, therefore, be held to be absolutely final but are, nevertheless, worth noting as very significant.

Wilcocks goes on : “ Three of the cases showed no physical signs at the time of discovery of acid-fasts in the sputum, which were proved to be tubercle bacilli by inoculation ” “ It will be seen that six of the cases whose sputum failed to give tuberculosis in animals gave a history of haemoptysis. This would seem to suggest some pulmonary lesion but not conclusively.” But it should be recalled that these six persons with haemoptysis also had acid-fast bacilli in the sputum—and that they *had* sputum. Surely it is not extravagant to postulate that all six had “ some pulmonary lesion ” of a fairly significant kind ! And yet not one of them provided sputum which, though containing acid-fast bacilli, was able to produce tuberculosis in that very susceptible animal, the guinea pig ! The sputum of these six patients was again examined, being still positive for acid-fasts, a year later at Cambridge and, indeed, two of them then produced definite tuberculosis in guinea pigs, but four were still unable to do so. Of the sputa in the Cambridge series, the list is given herewith :—

Sputa received	39
Direct positive cultures	6
Injected into guinea pigs	35
Induced T.B. in guinea pigs	15
Failed to produce T.B. in guinea pigs	19
Not counted. Animals died in 9 days	1

All these sputa were only 12 days old, having come from Tanganyika by air, and all were found to contain acid-fast bacilli. Why should a majority of them, nineteen out of 34 (one was not

counted as it died in nine days) fail to produce tuberculosis in guinea pigs? Wilcocks raises the question of possible leprosy but adds: "It should be clearly understood that no patient included in this report showed any signs of leprosy." He adds that E. Muir⁽³⁵⁾ reports that "lung leprosy only appears in cases in which well-established disease is present in other parts of the body." Why should leprosy be so mild in its symptomatology in these natives of Tanganyika and yet its bacilli be present in the sputum to a marked extent? It seems that some other explanation must be present. As Wilcocks puts it, "So far then, it can be stated that, if acid-fast bacilli other than Koch's bacillus do actually occur in the sputum of natives of Tanganyika, all attempts to cultivate them have failed." Here, then, is a challenge to further research as to the nature of these acid-fast bacilli which do not grow in culture. Are they tubercle bacilli at all or leprosy bacilli behaving in an atypical way? It is a research which is well worth doing. If they proved to be cultivable and were not tubercle bacilli how much of the problem of African tuberculosis might they not explain! It is necessary, in such a publication as this, to pay a tribute to the unwearying and intense efforts and to the modest methods of presenting his story which have characterized Dr. Wilcocks' struggle with this problem in his researches in Africa.

Several other papers by Wilcocks might be quoted but are left without mention here, as the article which is the subject of the above remarks seems to cover nearly all that is said in the others.

As was to be expected, especially in these latter days when the African is gradually assimilating his incidence to that of the European of a few years ago, it is natural that some of the younger writers should begin to hold views different from those expressed here. Dormer⁽³⁶⁾, Friedlander and Wiles, for instance, are not alone in taking a different line. In an excellent paper, following the same general direction as the South African Report (No. XXX) already quoted, they say "It is stated in all the books that the primitive races are more susceptible and less resistant to tuberculosis than the so-called civilized people. The disease in general tends to run a much more rapid course in primitive people and this is ascribed to a racial susceptibility or a racial lack of resistance. We are loth to subscribe to this as, in the South African Bantu in the native reserves, there is the problem of the high rate of infection combined with a low rate of disease in the same area to explain away. Why do not the tuberculin positive natives in the reserves die of the disease?" "The fulminating cases of tuberculosis seen on the mines occur in the first few months of a period of work. The transition from the Kraal, the loafer's

paradise, to sustained effort for many hours a day, is too abrupt. The primary complex, already probably unstable owing to malnourishment, breaks down into florid disease” “We believe that if we exposed Europeans to the same degree of malnutrition and sustained physical effort as natives when they were highly allergic they would succumb to the industrial type of disease.” But why, we should like to ask, do Europeans so seldom become “highly allergic”? The high allergy to which Dormer and his colleagues refer is that described in the South African Report (XXX) and is characteristic of the African—*because* he is so susceptible to the disease. If the Europeans were as allergic and as susceptible to the disease as the Africans they would be afflicted with the same type of disease; let us not call it “industrial” disease as Europeans are constantly engaged in the severest tasks of industry and yet seldom get it. The point is that they are less susceptible and, therefore, less allergic and so do not get the florid fatal tuberculosis of the natives.

We, too, have noted the low incidence of tuberculosis in the people of the Kraals and have explained it by their life of relative ease and—unlike Dormer and his team—to their frequent access to good and accustomed and well-cooked diet prepared by the wives, and to fairly well-organized though unconscious hygienic measures. Who could compare the hygienic conditions enjoyed by the natives in their widely separated huts to the miserable hygienic state of some mining villages? The unconscious hygiene of the native in his village is often superior to that of the European industrial worker.

PART IV.

“TREATMENT.”

It is not proposed to spend much time on the question of treatment as this is very largely the same for the African and other members of what were once “primitive” tribes, as for the European with the reservation that the marked susceptibility of the African, once his tuberculosis has been stirred up by any undue stimulus, makes the tuberculin therapy, for instance, almost an extra risk instead of a curative measure as it sometimes appears to be for the more resistant European. We shall quote Davies⁽³⁷⁾ first as he has been concerned with treating Africans in their own country and, therefore, gives a more vivid picture than the many others engaged in the treatment of American-African and others out of Africa for a good number of generations. The population of Kilimanjaro District is about 172,000. Of the whole District, the density of population is about 77.4 per square mile. On the populous mountain slopes it rises to about 400 per square mile. The Chaggas live “in bee-hive huts of banana thatching over a frame-work of poles. The thatch reaches to the ground and there is one small door but no windows.” At lower levels than between 3,500 and 6,500 feet above the sea grass thatching is used. “Huts are crudely separated into three portions by wooden piles” and usually accommodate the whole family, their cattle, goats and immediate belongings.” Agriculturalists by nature, their main products on which they live, are bananas, maize and beans.” On a report from MacNaughton that there was tuberculosis on Kilimanjaro, a small Sanatorium was started at Kibongoto, 25 miles from Moshi, 4,400 feet above sea level. “Most of the pulmonary cases died within a few months.” This will give an idea of the intensity of the tuberculosis in the district at that time. “It was found that tuberculin therapy was always most dangerous in persons showing large-sized local reactions.” The same thing was found in Burma by Cummins, not in treatment but in one or two of his test-cases in the course of finding out the degree of sensitivity to tuberculin in prisons. (This, however, is not mentioned by him in his report).

Families and contacts of known sputum-positive cases were tested by tuberculin and carefully examined. In this way, in one

village, the examination of 1,108 contacts in the families of 81 sputum-positive cases of tuberculosis revealed 82 further cases of tuberculosis and 526 persons who were infected, but had as yet no obvious clinical disease. In the same village 680 positive tuberculin reactors were followed up for a period of five years and 22 per cent. developed clinical disease." Religious missions usually kept a small number of beds for tuberculosis and, on being approached, agreed to allow treatment visitors once a week. "In this way there were ten 'points of contact' or 'tuberculosis Dispensaries' on the mountain through which patients could be found. . . ." "A large percentage of lymphatic and bone and joint cases were found to be contacts of sputum-positive patients" "The recording ledgers continued to show marked infection and disease in the members of families where a sputum-positive case existed." He records the case of a well-developed girl who, although in perfect health, gave a four plus or very marked tuberculin reaction. "Against advice she married into a family where the mother was known to be suffering from chronic pulmonary tuberculosis and, within eighteen months, she was admitted to hospital with galloping consumption. . . ." "In a further instance a boy with cervical lymphatic disease died from suffocation after tuberculin therapy, and post-mortem showed enlarged tuberculous glands right down into the mediastium on both sides." In the instances quoted above "the tuberculin apparently acted like a re-infection, causing intense focal reaction with, in some cases, alarming spread of the disease" As time passed it became noticeable that where families had made some attempts at personal hygiene and a sputum-positive case had used a sputum cup or where he had died or been taken to hospital, members of the family with early disease or with large-sized tuberculin reactions, but no symptoms of the disease beyond a general lassitude, gradually began to lose their large-sized reaction and regained health and strength."

"At the end of 1936, our recorded cases were as follows:— Pulmonary, 1441 (940 sputum-positive); lymphatic, 498; spinal, 72; bone and joint, 73; disseminated, 20; meningitis, 6; peritonitis, 7; eye, 2; lupus, 2; primary intestinal, 1. Using Cummins' classification the pulmonary cases were grouped as follows:—

A1	..	15 per cent.
A2	..	11 per cent.
A3	..	25 per cent.

C1	..	13 per cent.
C2	..	8 per cent.
C3	..	28 per cent.

In 1932 and 1933, the following advantages were added to the Unit: a car to make visits possible, a pneumothorax apparatus,

an X-ray outfit, and those acute exudative cases were treated with A.P.

Of 261 cases, from January 1933 to December 1937, 219 or 84 per cent. were treated with artificial pneumothorax. The remaining 42 or 16 per cent. had purely operative treatment. There were 273 inductions and 4,322 refills, all carried out by the Unit. The results, up to date of the article (1938), were as follows :—

Type	Number	Unknown	Known	Dead	Alive	Working
A ₃ ..	54	6	48	22	26	10
A ₁ & 2	24	1	23	2	21	17
C ₃ ..	34	7	27	16	11	9
C ₁ & 2	14	1	13	0	13	10

Of a total of 219 subjected to A.P., sometimes with oleo-thorax, phrenecotomy, etc., 19 could not be traced; of the remaining 200, 77 were dead, 123 alive. Of the 123, 83 were working on 31 December, 1937; 44 had been alive and working for more than three years.

34 per cent. of 87 A₃ type died within 12 months, as against 92 per cent. of the “ medically ” treated.

27 per cent. of 100 C₃ type died within 12 months, as against 73 per cent. on “ medical ” treatment.

Village Settlement. Five or six families are living on farms provided by the Government and carry on their normal agricultural pursuits in healthy surroundings under medical supervision.

“ Wilcocks’ admirable suggestion that the intradermal tuberculin test should form part of the general medical examination of recruits for labour with exclusion from work of the marked reactors unless under medical supervision ” is praised by Davies as a sound measure.

This description of the results of A.P. in Africans is very hopeful and justifies a favourable opinion for collapse therapy amongst natives in the future. On the other hand, the following article by Hoffman⁽³⁸⁾, reporting on the same treatment in American negroes, a people more readily placed in an advantageous position, one might suppose, than the native African, sounds a note of caution. His records deal with 358 negroes seen and treated in a period of 9 years. “ The material comprised 12 minimal, 246 moderate and 100 far advanced. . . . Out of this total (including 45 bilateral) adhesions were encountered in 90.5 per cent. and prevented the achievement of complete collapse in 83.4 per cent. . . . A comparison of the discharge rate between the effective and the ineffective pneumothoraces shows that the rate is more than twice as high in the former. A

comparison of the complication rate in the ineffective and effective pneumothoraces shows that complications leading to abandonment or death occur more often in the former. Unless a pneumothorax can be rendered effective (by closed pneumonolysis) it should be abandoned. . . .” “A review of all the admission films of the 358 cases in the study was followed by the definite opinion that, “were the opportunity again presented to decide on the use of pneumothorax, it would be withheld in a rather large number of cases.” The author concludes: “Unless pneumothorax is aided by some supplementary collapse procedure it is markedly inadequate in the treatment of pulmonary tuberculosis.” This view of the treatment of Africans by artificial pneumothorax is not, as it is in the case of Europeans, strikingly favourable, but neither is it wholly unfavourable, and it definitely suggests that collapse, be it by the addition of closed pneumonolysis or otherwise, is often an advantage if it can be obtained; after all, there were evidently some effective pneumothoraces! Placing these two papers together as accounts of collapse therapy in the very severe cases met with in Africans, we hold that the treatment is certainly worth considering, and that it is likely to be followed by success in some at least of these otherwise hopeless cases. From the records of Davies, in fact, it would seem that the native African, not removed from his own country but operated on where he has the advantage of his natural food and the presence of his relatives around him, is more prone to recovery than his type separated by eight or ten generations in a foreign country. We have, for the purposes of this paper, decided not to deal with the great developments that are now evident in India; they require consideration in a report devoted solely to that country; but we cannot resist the temptation to mention the very favourable results now being recorded from that country both as regards artificial pneumothorax, thoracoplasty and the other forms of lung collapse. Benjamin⁽³⁹⁾, one of the stalwarts of Indian phthisiotherapy, has gallantly proceeded with all these methods, first inspired by Frimodt-Möller and, after the loss of the latter, on his own initiative, and in his recent reports, has shown how well Indians react to these measures. What is true of India, with its very susceptible population, is very likely to prove true of Africa also. We might quote many more articles on collapse therapy both from South Africa and America, but space forbids and we forego the pleasure of doing so beyond the mentioning of the two papers that have interested us most. Before we turn from treatment, however, we must speak, though in haste, of another method; the use of his Endotoxoid by Grasset⁽⁴⁰⁾, of the South African Institute of Medical Research. “Since 1936,” he says, “we

have used selected strains of the human type of tubercle bacillus (including the Saranac T.B.—avirulent—kept on bile medium from 1910 to 1936). . . . In the native treated with endotoxoid the most frequent change is a stabilization of weight. Night sweats disappear. Radiological examination shows quite a definite improvement.” Of all forms of treatment, the administration of a vaccine would seem the most promising but, in the chronic tuberculosis of Europeans at any rate, it has not, so far, produced results of much value. Grasset seems quite convinced, however, that in the hyper-allergic and very susceptible African native it gives good results. The type is different. He may be right.

PART V.

CONCLUSION AND SUMMARY

The foregoing Report has dealt briefly with the problems of tuberculosis as it has affected various communities, tribes and individuals more or less cut off from the associations of civilized mankind until recent years. It has shown, or it seems to the author to have shown, how greatly the human race is dependent upon the constant interchange of communications with its fellow men, for the development not alone of its culture but of its relative immunity to the plagues that beset it; notably to that plague of plagues, tuberculosis.

Let a community, a tribe or an individual be brought up in such isolation as to be free from the ravages of a given germ; let a collection of agricultural or pastoral peoples be so shut off from the great towns or cities that little communication exists with the urban inhabitants; let any geographical interruption, isolation in high and untraversed mountains or a cutting off of touch with the outside world through surrounding desert or bush country, interrupt for long ages the meeting with other peoples; there we must expect that the germ of tuberculosis, the Koch bacillus, will be likely to be absent or very thinly present in the environment of the average man, woman and child. Bring such an isolated person into sudden touch with the tuberculized and relatively resistant peoples of old and intimate association with each other, and the risk of tuberculosis will be great for the hitherto isolated man. And not only will the risk of his meeting and being affected by the germ be great but his risk of an acute, fulminating and fatal attack, where the tuberculized individual of long accustomed stock shows only the half-obliterated traces of disease, will be the penalty that he must pay for his previous isolation.

For the British nation such a state of relative unpreparedness for tuberculosis in its more primitive Colonies and Dependencies is extremely important, both from the standpoint of humanity and that of economics. It is not to be expected that the facts should be appreciated by the general public, naturally blind to a tragedy only to be understood by those with a special interest in what is, after all, a medical problem. But that the medical profession itself should be almost unconscious of such human suffering amongst

the subject peoples and nations that have come to be governed by us is harder to understand. And yet even the medical profession is, after all, only a collection of medical individuals, each fully occupied with his own particular problem of sickness in his practice and concerned with tuberculosis only as he meets it—a hard enough problem even in its modified and relatively resistant form. After all, it is only since 1911 that we have had a National Medical Insurance Scheme and that the medical profession has started to become sufficiently organized to act as a unified body ! But, outside England itself, in the territories that present this terrible tragedy in its naked shape, medical men have become only too conscious of the extreme susceptibility of our “ native ” fellow citizens within the Empire. Sometimes it has been thought to be the result of the degraded conditions of general and personal hygiene that were principally to blame ; and there is no doubt that the hygiene of the native is non-existent except in such unconscious actions as have grown up with the growth of the tribes ! Sometimes it has been attributed to dietary deficiencies ; perhaps because Britishers tend to be a little confused between the relative values of a British diet, and the far more subtle natural diets gained by the native housewives from the roots and fruits of the forest and the game brought to them by their menfolk, and partly because of the true and terrible dietary deficiencies that occur when natives are divorced from their natural surroundings, and are left almost penniless to form large and horrible villages of flattened tins and spare bits of corrugated iron in the neighbourhood of British colonial towns, with their well-ordered arrangements for food and housing. And some of these medical men, allowing for the combined effects of bad hygiene, bad diet and bad housing in the natives, have still seen that there must be something else, something less obvious, something infinitely important, to account for this universal native susceptibility to tuberculosis ; something that acts on the rich man with his wives and children, the strong healthy tough tribesman, well fed according to his historic customs, and the miserable Europeanized native, most of all, amidst his festering purlieus and his hard-won but deficient diets. The idea that former isolation and present want of relative immunity co-exists with all the other phthisis-favouring factors and “ blends and transcends them all ” has an immense importance because it points to the special precautions which are possible to shelter the native both from European contact as much as may be, and from sudden and unprepared-for stresses such as are faced when a man goes straight from his native leisure into the severe and physiologically trying atmosphere of a European industrial concern.

THE NATIONAL ASSOCIATION FOR THE PREVENTION OF TUBERCULOSIS.

While the bulk of the medical profession in Britain remained ignorant of or inattentive to the vast problems of tuberculosis overseas, there was one body to which the extreme prevalence of the disease amongst the native races of Africa and elsewhere was far from indifferent, the National Association for the Prevention of Tuberculosis. This great organisation had, under the inspiration of Sir Robert Philip, incidentally the Chairman of the Council, and Professor of Tuberculosis in Edinburgh University, been keenly aware of the disabilities under which the natives of our Empire suffered and their marked susceptibility to the disease. The National Association had the zeal to help in solving this problem and the power of selecting the right men from amongst the tuberculosis specialists available; the provision of funds, too, was a matter on which they could go a little way though not to the extent which they knew to be necessary. It was with the Association thus ready and willing to assist if opportunity occurred that one of their members, Mrs. Albert Pam, called attention to the alleged extreme prevalence of tuberculosis in the Island of Cyprus which she had just been visiting. Here was a small island completely cut off from all contact except by sea with the neighbouring mainlands, and without any adequate tuberculosis services on which to call for information. "The Council was sympathetic but desired fuller information. By a happy coincidence another member of the Council—Mr. H. A. Baker—had arranged to visit Cyprus shortly and offered to make further inquiry regarding the situation. His report underlined the urgency of the appeal."..So says the Foreword of the Report which subsequently appeared under the title "Cyprus. A Survey of Tuberculosis and Means of Control." In the event, after conferences with His Excellency the Governor of the Island, Sir Richmond Palmer, K.C.M.G., C.B.E., and other interested authorities, Dr. Noel D. Bardswell,⁽⁴¹⁾ M.V.O., M.D., F.R.C.P., F.R.S. (Edin.), and Nurse Commissioner Jays, a lady with a thorough knowledge of Greek, consented to go to Cyprus and make a thorough survey of the Island as far as might be possible. His report on the work there in 1936 and 1937 is briefly reviewed here in amplification of the remarks already made, but it must be read in the original by all those interested in the question of tuberculosis as it affects those born in the isolated portions of our Empire. There existed in Cyprus an Anti-Tuberculosis League which was soon affiliated with the National Association for the Prevention of Tuberculosis, and which was of great assistance

to Dr. Bardswell in his subsequent investigation. "When I arrived in Cyprus," he says, "in November 1936, under the direction of its Chairman. Dr. E. A. Neff and its Hon. Sec. and Treasurer, Mrs. E. Passingham, the League was firmly established." The first steps were the location of a Tuberculosis Dispensary at Nicosia,—a suitable place being found for this in the clinic of Dr. Evangelides, a local doctor much interested in tuberculosis and who became Medical Officer to the League. "Another important development in prospect" was made possible by a gift of £3,000 by a benevolent friend of the Association, Mr. D. M. Demetriou, O.B.E., of Larnaca, to the Government of Cyprus for the treatment of the disease in the Larnaca district, where the Larnaca Hospital has a first-rate X-ray installation and where the building of a tuberculosis dispensary was at once decided upon. Dr. Bardswell commenced his duties by making a tour of the Island with Dr. Neff and by meeting the British Resident Commissioners of the six administrative areas of Nicosia, Limassol, Larnaca, Famagusta, Paphos and Kyrenia as well as their mayors and principal citizens. The result of his enquiries, at this visit, was to give much verbal evidence of the terrible prevalence of tuberculosis and of the fear that everyone went in as a result of this grave infection, and at the same time, of the almost complete impossibility of founding sanatoria or creating dispensaries owing to the great danger that might be expected from a concentration of infected persons in any one place. Naturally, Dr. Bardswell was somewhat doubtful of the reliability of much of this evidence, which appeared dependent on panic rather than on any real facts but which had still the repeated confirmations of many of the Mukhtars or Heads of Villages when he proceeded to ask them about the tuberculosis question.

"It seemed essential," writes Bardswell, "in the first place to attempt to verify the facts as they were told me. For this purpose the best course seemed to be to tour the island and learn at first hand as much as could be learnt by anyone ignorant of the people, its ways and the language, and trusting, therefore, to an interpreter and one's own powers of observation." This led, at first, to much hearsay evidence confirmatory to the desperate situation already described as, for instance, the following:—"At one village I found on arrival that there was a resident assistant sanitary inspector who appeared to be intelligent. 'Is there any tuberculosis in your district?' I asked. 'A great deal,' he replied. 'It is bad about here!' 'What is the size of your area?' 'A radius of about 12 miles.' Nearly half an hour of close questioning resulted in his telling me that there had been cases in the district but that, at the moment, he knew of only one, a young woman living in a

neighbouring village. He described this patient with much detail as a most pitiable case ; very ill and living in extreme poverty ; " Not a piastre in the house." Dr. Bardswell went to the address indicated. " I found her sitting at the door outside her single-roomed windowless house along with other young women working at embroidery." " I found her to be suffering from disease of both lungs of a chronic type, afebrile and with no constitutional symptoms." The woman did not appear to know that she was suffering from tuberculosis and was carrying on as if no disease existed but, though she was silent on the subject, Dr. Bardswell gained an idea that she was less ignorant than she appeared to be ! This instance, and many like it, convinced Bardswell that the alleged number and gravity of the tuberculous cases was the result of the fear of the disease and the reluctance to look for cases that affected medical officers, administrators and other officials alike, and that the facts were very different from the accounts given by these timid public servants. He visited towns with a population, altogether, of 65,000 and villages with 123,011 persons as a total. " I think," says Bardswell, " it can be said that the area covered was large enough and sufficiently representative to be considered a fair sample of the whole population of the Island." He thought the tuberculosis question to be much exaggerated. " The truth appears to be that, since the British occupation of the Island, tuberculosis has, in a sense, been discovered in Cyprus and that during the past decade or two many people on the Island have heard of its existence for the first time." The numbers of notifications of all districts appear to have fallen in recent years ; from 319 cases in 1931 to 101 cases in 1937. The ages of notifications appear to reach a maximum between 20 and 30 and then to fall to very low figures ; a type of disease-age incidence which is quite unlike our own urban incidence but characteristic of an almost tuberculosis-free rural area. The " evidence obtained with the tuberculin test," however, is much more reliable than the very rough statistics available. In conjunction with Sir Robert Philip, the percutaneous method of tuberculin testing was used ; " There is little or no difference between the sensitiveness of the Von Pirquet and Moro methods," says Bardswell. We have the impression, nevertheless, that the Moro test is, on the whole, less sensitive than the Von Pirquet though the difference may not be very great. We mention this as the comparison between the Cyprus tests and those of Burma which were carried out by the Von Pirquet method will be, as is shown later, on the whole, in favour of Cypriot villages. In such a summary as this it is useless to give details of particular villages though the results are set out fully in the text. Suffice it to say that the result in the six villages

of Famagusta, Larnaca, Limassol, Paphos, Kyrenia and Nicosia, representing tests on 8,084 children, was only 6.5 per cent. That in the District Towns, representing 1,841 children, was 8.2 per cent. These results, even allowing for a slightly lessened sensibility to the Moro test, must be almost unique in character; far smaller than many, even, of African villages and towns.

It should be said that Nurse Commissioner Jays was of great use in these investigations, not only through her nursing skill but above all, her intimate knowledge of the Greek language which put her on a familiar footing with a majority of the inhabitants. Those Turkish families who did not speak Greek were communicated with through an interpreter. The tuberculin testing did more than show the numbers that had been exposed to infection; it very often led to the discovery of cases. "At Vatili the source of positive reaction of three of the school children was traced to their tuberculous father; an aunt in the adjoining house also gave a positive reaction" "Nurse Mavridou, working for Dr. Bevan in the Larnaca district, was able to associate some 90 per cent. of positive reactors to the Moro test with cases of pulmonary tuberculosis." Other instances are given and it is clear that, with ample time, this clue might be followed up to a very considerable extent. Speaking of the sources of infection, Bardswell expresses a truth which has often come to our knowledge in Wales and other more or less isolated places:—that much of the infection comes from men returning from other countries where they have contracted the disease. "I have been impressed by the frequency of the introduction of tuberculosis into Cyprus from outside the Island. Repeatedly in every district the same history is given. Mr. X worked in Egypt for some years, returned to his village an ill man and died within twelve months. My notes contain many variations of this record." Many instances are given of the gross overcrowding and even the sharing with animals of the shacks in which the people live. The report is beautifully illustrated with photographs and maps, but these must be studied in the original. To sum up, the account of Dr. Bardswell's visit to Cyprus shows not only that the local accounts of the prevalence of tuberculosis are greatly exaggerated, but that the Island is still singularly free from the disease as proved by the low tuberculin positives among the children, and by the suggested liability to contract the disease shown by those who have succeeded in getting work in other countries more afflicted by tuberculosis. We note, too, the tendency of those who are so unfortunate as to contract tuberculosis in the course of their daily life on the Island, to show very chronic and benign types of the disease; a state of things recalling the slow and chronic course

shown by the women and children in villages of the Ciskai and Transkei in South Africa ; whereas those contracting it in strenuous work abroad appear in Cyprus too to die of it.

This valuable Report carried out at the sole expense of the Association was widely studied by those responsible for our Colonies and Dependencies in which they saw a great deal was to be learnt about the tuberculosis of more or less primitive communities. In 1938, came a request from the Leprosy and Tuberculosis Association of Burma that the National Association should choose and send out an expert to investigate tuberculosis in that country, and advise as to what measures should be taken against it. The Leprosy and Tuberculosis Association of Burma undertook to bear all reasonable expense in what, it was hoped, would prove a valuable study of the extent of the disease in that country. Professor S. Lyle Cummins⁽⁴²⁾, C.B., C.M.G., M.D., having offered to go out to Burma provided that the travelling expenses of himself and Mrs. Cummins were guaranteed by the Burmese organisation, was appointed by the National Association for the Prevention of Tuberculosis to carry out the task. He sailed on October 20th, 1938, accompanied by Mrs. Cummins as his Secretary, and reached Rangoon on November 18th, 1938.

The population of Burma is about 14,000,000. Of this number, 433,361 are concentrated in Rangoon, a city which is much more mixed in type of inhabitant than any other centre in Burma, owing to the large number of short-service Indians employed on the Docks and in industry. Cummins spent over a month in Rangoon where he was hospitably entertained by His Excellency the Governor, the Hon. Sir Archibald Cochrane and Lady Cochrane, Major Bozman, I.M.S., and many others, and where the general hygiene among the Indians, the majority of the population, and the town-bred Burmans left much to be desired and constituted a problem for the Health Officer to the Corporation, Dr. B. P. Srivastava, and other medical officers. Here there was no tuberculosis hospital or sanatorium at all, for this very large and very much tuberculized population, and the advanced cases diagnosed, a relatively small proportion, had to be admitted, for the most part, into the General Hospital, where they usually died in a very short time, a time often to be reckoned in weeks or days after admission. One element of a Tuberculosis Service there was, however, in the shape of an excellent Tuberculosis Dispensary served, as regards treatment, by Dr. Malhotra, a thoroughly able worker, who was carrying out artificial pneumothorax, gold therapy and other forms of modern treatment in numerous cases. The unfortunate part was that the tuberculous patients had to be treated in their homes and that, for this reason,

the object of the Clinic, to limit the amount of infection for the community, was very greatly interfered with or rendered nugatory. In conjunction with this clinic and, still more, at the General Hospital, Cummins had opportunities of seeing cases and forming some idea of what the tuberculosis problem was like in Rangoon. "I consider," he says, "the cases of pulmonary phthisis to be of two types; those arising in persons not exposed to severe stress but living peaceful lives, often under village conditions, and, though sputum positive, not at first or perhaps later much afflicted by the onset of the disease, and those, as in the jails or amongst coolies, who break down suddenly into an acute and fatal type, characterized by all the signs familiar to the tuberculosis expert." Cummins was much helped by Dr. Kundu, Director of the Harcourt Butler Institute, and his staff, and was also greatly assisted by a Doctor lent to him as one who intended to come to Cardiff later and to take the T.D. Diploma, U Than Aung. Cummins and Mrs. Cummins, using the von Pirquet test as modified by him, carried out many experiments to ascertain the degree of infection prevailing in Rangoon and found it to be very high both in school children, their masters and mistresses, and in the persons imprisoned in the Central Jail who were all tested and recorded. They visited the houses of Indian and Burmese workers which they found to be extremely bad, carried out an examination of the post-mortem books kept at the General Hospital—time was too short to allow them to see many autopsies—finding that, of 1,106 persons examined, 315 had turned out to have tuberculosis; the lungs being affected in 274 cases or 87 per cent., abdominal organs in 170 or 54 per cent. "either tuberculosis of the intestines, caseous mesenteric glands or both," while 8 per cent. had either frank miliary or an element of miliary tuberculosis in them. The cases were, at least, not so acute as those in South African natives already referred to, but still they were of a very acute type. "We went," says Cummins, "into the question of registrations of death, on which the accuracy of tuberculosis returns so intimately depends, and we found that the Registration Medical Officers had to decide, in the majority of cases, whether corpses brought to their notice for registration purposes had died from tuberculosis or from some other disease. While it is impossible to be sure of figures so obtained, it is at least likely that they represent an approximation to the truth, the actual numbers being, if anything, too small." This means, however, that the tuberculosis statistics are open to question and that no very sure figures are to be had at present, although Dr. Srivastava was making a gallant effort to keep them as nearly correct as possible. "Racial differences apart, however, the

exposure to infection in Rangoon is as high as in England but *the deaths are about four times as high*, allowing 0.7 per mile as the death-rate in England and Wales." The death-rate from tuberculosis, all forms, amongst the mixed population of Rangoon for the year 1937, was placed as high as 2.97 per million and "it is estimated at 3 per million at the present time."

Finding that the possibility of examining many patients in Rangoon was remote, owing to there being no hospital or sanatorium for tuberculosis, Professor and Mrs. Cummins and Dr. Than Aung decided to move out of the city and to pay close attention to the prevalence of the disease elsewhere.

Everywhere they found the conditions of the people with regard to housing to be very bad, their food, while naturally of Burmese type, not above reproach by British standards, their economic state to be very low and their habits of life such as to spread infection with tuberculosis if it were present in considerable amount. At the same time, however, they found reason to believe that tuberculosis was far from prevalent in most of the provincial towns investigated. This relatively marked absence of tuberculous infection from the majority of places throughout Burma was assessed by the small numbers of "positives" to the tuberculin test found amongst children and even, in some places, amongst adults, these provincial towns and villages thus presenting a sharp contrast with Rangoon where there had been evidence of a prevalence of tuberculin reactivity very much the same as in London or any other city of large size.

Thus, in Mandalay, there was a percentage of only 3, in Shwebo 4, in Maymyo 3.7, in Bassein 9, and in Moulmein 11 in children up to ten years of age, *contrasting sharply with 26 per cent. in this age group in Rangoon*. There appeared to be considerable differences between the adults of different races. Thus, in the analysis of men tuberculin tested in a Territorial Battalion of the Burma Rifles, the results were as follows:—Karens 25 per cent., Kachins 57 per cent., Chinese 41 per cent., Burmans 19 per cent., Gurkhas 55 per cent. and Indians 37 per cent. It was not suggested that these percentages were necessarily typical, the men being merely the few who happened to be present in this Unit, but it was possible to infer from the results that the Burmese were far less infected than, for instance, the Kachins or the Gurkhas in their villages and the places from which these men were drawn. Professor Cummins made various suggestions as to the building of Hospitals and Sanatoria for the tuberculous and for the extension of the tuberculosis service in Burma, which were well received at the time and might probably have borne fruit; but the outbreak of war and the subsequent occupation of Burma by

Japan threw all possibility of progress to the winds until such time as may be necessary to replace Burma on an economic footing.

The last of these special Surveys, and far the most thorough, is the Tuberculosis Survey of the Islands of the West Indies by Dr. Santon Gilmour⁽⁴³⁾. This survey was assisted by the Colonial Office through sending the observer out as a Colonial Office Official for a period of over a year, to say nothing of his being paid, on a nearly half-and-half basis by the Colonial Office as well as the NAPT. This officer had previously worked for some years in the Welsh National Memorial team in various capacities and later, in charge of the principle Sanatorium in Leeds. He was, therefore, a particularly well-trained man in the field of tuberculosis as well as one known to the Council of the National Association as possessing the personality and character requisite for the important work envisaged. It is still too early to attempt more than a brief summary of his studies in Trinidad and Tobago, Barbados, British Guiana, the Bahamas, etc., which are available to us but not yet published. It is thought well, however, to touch on the principal points of his Survey as far as they illustrate the contrasts between the tuberculosis of Africans of the old slave type introduced by the Spaniards, the French or the British when they governed the islands in their turn, the descendants of East Indian Indentured labour, personnel introduced from India by the British, the coloured mixtures of these through racial fusion with their masters and finally, Europeans residing among them for industrial or professional purposes and for pleasure. These racial types, while gaining relative immunity by degrees through contact with the Europeans or with each other, still show a variety of tuberculous disease distinct from that of the European and white Americans though very much the same as that of the African-Americans of similar origin to themselves. The population of Trinidad is roughly as follows :—

Total Population	..	..	..	535,499
East Indian	..	..	..	180,509
Others (chiefly African)	..	..	..	354,990

In addition to the Africans, the group of “ others ” includes the European and the Chinese groups of approximately 5,000 each. “ The total urban community is estimated to be 128,366, leaving a rural population of 407,133.” Port of Spain is the principal city and, with its population of 103,155 persons, of permanent or semi-permanent character, has been the point of arrival and, to a considerable extent, of residence of large numbers of American troops during the war. The type of house throughout the Island is generally built of timber with corrugated iron or some other

roofing ; flattened oil drums, perhaps, which also often form the walls and fence as well. These are often grossly over-crowded. " It is only too obvious that one individual with open tuberculosis, under such circumstances, cannot help infecting his or her house and bed fellows." Traditionally, carbohydrates form the bulk of the diets : bread, imported and home-grown rice, sweet potatoes, cassava, yams, bread-fruit, maize and bananas. " Proteins are generally short, imported fresh and salted meat and salted fish are frequently used as flavouring agents rather than foods. Fresh milk is little used by the masses and, because of the climate, is always boiled. The commonest form of milk is dried or condensed, the sweetened variety of condensed being popular. Citrus and other fruits are plentiful in season and universally eaten." We learn from Santon Gilmour that " There is considerable poverty ; the numbers treated as indigents by the Government Medical Officers daily are significant considering that they represent income up to \$20 per month, roughly twenty shillings and eight-pence in British currency per week." Mortality rates for Trinidad and Tobago are given but must be consulted in the original. It is sufficient to say that, in 1896-1900, the total deaths were 2,750 per 100,000, the deaths from tuberculosis, 275, malaria 342, enteritis 504 and respiratory diseases 178 ; while in 1943, the total death rate was 1,645, tuberculosis 100, malaria 110, enteritis 12 and respiratory diseases 232 ; a fall in the tuberculosis death rate which shows that, even here, the natural processes of protection against the disease, aided by human endeavour, have been operative to good effect.

It appears, from old records, not from statistics for there were none kept, that tuberculosis was very rare in the early years of the nineteenth century in Trinidad. " The population of slaves who had come as virgin soil from Africa had not met the disease and, because of their isolation in their work on estates, did not come into contact with it with any frequency and thus remained practically free from infection. Unfortunately, however, after emancipation their economic situation became rather worse than better. They could move around better and mix with others, and soon met tubercle bacilli whilst living under the worst possible conditions. The disease became almost epidemic." The disease seems to have passed from about 700 per 100,000, by a gradual improvement, to the low figure of today. The East Indians are not much better than the Africans. Throughout the island the rural death rate from tuberculosis is placed by Gilmour at approximately 50 per 100,000 as compared with an urban death rate of 200. Taking the whole island and all its inhabitants together, it is found " that 71 per cent. of the cases died within 12 months of

notification ; 64 per cent. of them actually in the same year ; and of these 73 per cent. died in less than three months. A small number, 15 per cent., survived up to two years, and only a fractional percentage remained after three or five years." It is to be remarked that no whole-time Tuberculosis Officer is employed either outside or in the hospitals service. The work is in the hands of District Medical Officers, who, though allowed to carry out private practice, are Government servants and see a great many indigent people for nothing. There are good hospitals for general diseases to which advanced cases of tuberculosis are admitted, one at Port of Spain with 460 beds and the other at San Fernando with 230 beds. While there is no sanatorium or tuberculosis hospital, the Colonial Hospital, Port of Spain, a special building erected many years ago, houses about 54 tuberculous patients and at San Fernando there is another ward with accommodation for 12 patients. These beds are obviously inadequate and unsuitable.

For the survey by means of tuberculin, concentrated "Old Tuberculin" supplied by the Connaught Laboratories, University of Toronto, was used. The doses were two in number, 0.1 cc. of 1/10,000 and of 1/1,000 dilution. Stainless steel 26-gauge needles were used. The Mantoux technique was followed. For the urban tests, schools from those in Port of Spain were chosen and rural schools were selected in different parts of the island drawing from village communities and scattered rural dwellings. Some were selected as drawing their pupils from East Indian children only. The results of some of these tests are quoted, but the majority must be studied in the Report itself when it appears.

URBAN SCHOOL CHILDREN

<i>Age</i>	<i>Males</i>		<i>Females</i>	
	<i>African</i>		<i>Indian</i>	
	0.01	0.1	0.01	0.1
5-9	15.6	15.5	20.0	5.0
10-15	29.9	16.1	48.2	90.0

RURAL SCHOOL CHILDREN

	<i>African</i>		<i>Indian</i>	
5-9	9.6	11.5	4.5	3.4
10-14	21.0	21.4	9.8	19.5

"When infection rates have been so low in rural schools, it has been possible in the majority of positive reactors to trace the source of infection back to the home, either still present or removed by death. Frequently a previously unknown case of open disease

is found in this way.” As to the findings in adults “ the general urban rates are 87.1 per cent. in African adults and 88.8 in East Indians in contrast to rural rates of 68.1 and 49.4. “ The highest rate is found in those of 55 years and over, but this group is not highly sensitive, the majority of positive reactors being found to 0.1 per cent.” This is not a proof that hypersensitivity is absent as, even with extreme hypersensitivity, there is likely to be more reaction with 0.1 mgr. than with 0.01 mgr, but it is probable, all the same, that it is far less marked than in the recently “ primitive.” The type of infection was found to be very severe. There is a good X-ray plant at the Colonial Hospital and this hospital was chosen as the venue on a fixed day.” In the West Indies there has been a considerable shift from the “ primitive ” state and even the relatively modified state at present seen in Africa where there may be found extreme sensitivity to tuberculin and yet only slight immunity. Here there is often a high degree of immunity and a titre of allergy as low as that in Europe or America.” Gilmour states that the disease type is as follows :—“ Pulmonary disease is in the main the adult type, at its worst similar to primary lesions, with extensive exudative processes, haematogenous metastasis and short course, but without the gross caseation of tracheo-bronchial nodes ; it passes through modification of this to a small proportion of limited chronic disease, apical and latent lesions. . . .

“ Tissue destruction continues with little effort at repair, cavities are without fibrosis and have ragged walls. Intoxication is great, with hyper-pyrexia, unstable pulse and other signs of considerable constitutional upset. . . .”

“ The Africans tend to present more acute than chronic disease, the Indians less disease proportionately and tending towards chronicity ; although, on the other hand, not being urbanized, a proportion are highly allergic and succumb to acute disease.” The X-ray films correspond fairly well to these findings. A mass radiological and fluorographic survey, however, has recently been set up on a 35 mm. film and is giving a more correct idea of the state of the population to tuberculosis. “ The impression at present is that there are more moderate and minimal cases in the population than had been anticipated.” Treatment is briefly discussed and appears to be fairly satisfactory allowing for the severe type of case.

The other Islands are also discussed and the situation, as regards tuberculosis, shown to be the same and the arrangements for it worse than in Trinidad. Everywhere we see the same slightly modified but, on the whole, very noticeable susceptibility to tuberculosis and a race very difficult to cater for, there being

neither sufficient financial strength nor great willingness to rise to the level of effort necessary to overcome the disease. Still there is strong feeling, in these latter days, that the British Government should step in and provide the beginnings of an adequate service and the work and money of the European section of the population has been proffered in a thoroughly adequate way. Dr. Gilmour's visit has corresponded to a strong local effort and the plans for a sanatorium of 250 beds, as a beginning, and the provision of sufficient staff, a Tuberculosis Officer, rehabilitation arrangements and the other facilities of a proper service are already in hand. "It is proposed that the Government undertakes financial responsibility for the clinics, the hospitals, their staff, the treatment of patients, any schemes of maintenance or rehabilitation and the general public health activities of the service. The Association (The Trinidad and Tobago Association for the Prevention of Tuberculosis) would find its usefulness in social welfare."

What, then, are we to conclude as to the contrast between primitive peoples and civilized communities and the kind of tuberculosis to which they are liable? Tuberculosis is undoubtedly the same disease whether it strikes the members of civilized communities or the primitive tribesmen and their far less primitive descendants that we meet with today. But it strikes the civilized in one way and the less protected primitives in another, the difference depending not on "allergy"—*that* is always a character acquired after the tubercle bacillus has entered the body—but on the rapidity with which relative immunity is acquired on the tuberculous infection taking place. Relative immunity is acquired rapidly by the civilized, slowly by the "primitive," and at an intermediate rate by the descendants of the latter. The clinical disease, when it outstrips relative immunity and produces disease in the civilized man, does so in a modified and protracted way. It tends to produce a chronic, localized illness, accompanied by fibrosis, which, though it often breaks down the immunity completely and leads to death, still very often recovers or partially recovers and is amenable to skilled treatment. In the "primitive," however, it usually produces a far more acute kind of disease which tends to kill its victim rapidly without any of the delay caused by fibrosis—though the process may lead to some fibrosis, especially in the descendants of "primitives" who have been exposed to the infection for several generations, in the tissues around the lesions. In this

connection we must refer to the theory propounded by the writer which he expressed in 1932, as follows:—"The newer concept postulates not so much the inheritance of immunity as the inheritance by our European races of a power to respond to infection in a more favourable way than "primitive man." This power, we think, is the factor which operates to bring about the contrast between "civilized" and "primitive" peoples which we have stressed in the foregoing pages.



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